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THE ALLOCATION OF RUNWAY SLOTS BY AUCTION. VOLUME II. THE AIRLI--ETC(U)

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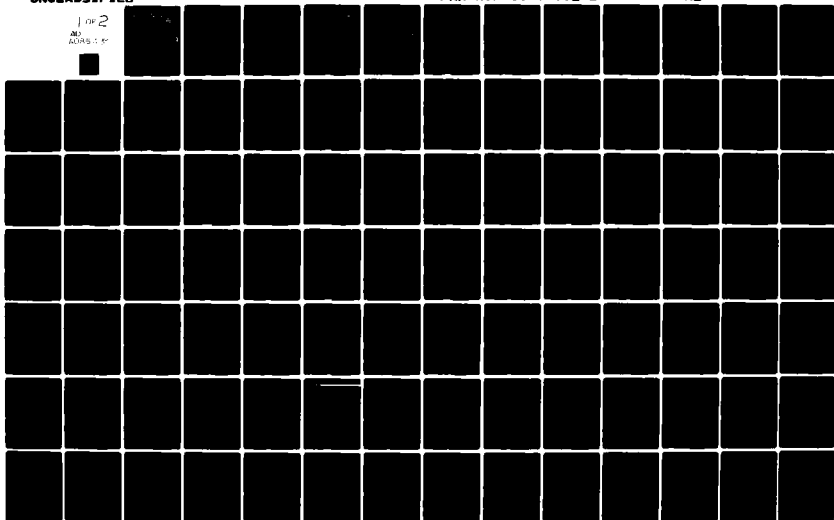
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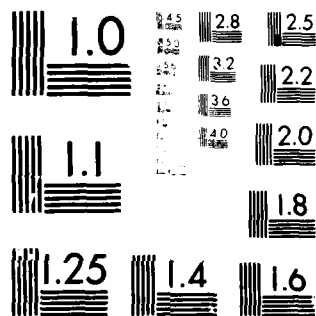
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Volume II



U.S. Department  
of Transportation  
Federal Aviation  
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Office of Aviation Policy  
Washington, D.C. 20590

# The Allocation of Runway Slots by Auction

## The Airline Management Game and Slot Auction Testing

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April 1980  
Final Report

M.L. Balinski  
F.M. Sand

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16. Abstract The allocation of runway slots at the high-density airports by means of an auction is studied. Previous approaches to slot auctions have not allowed for the interdependency of slot values to the air carriers--a single slot for a landing of an aircraft is likely to be of little value without a corresponding slot for a subsequent take-off of that aircraft. A Slot Exchange Auction is designed, its theoretical properties and practical implementation discussed. It is shown to allow the slot market to reach an efficient equilibrium under competitive conditions. The Airline Management Game is used to create a simulation test of the Slot Exchange Auction and its associated continuous market, the slot exchange.		
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## 1. INTRODUCTION

In order to evaluate the viability of the Slot Exchange Auction\* and subsequent continuous slot exchange, an interactive computer simulation of actual slot auctions was conducted using the Airline Management Game; participants from the airlines acted as airline executives engaged in bidding and scheduling activities. This Evaluation Exercise held at FAA headquarters in Washington, D.C., February 11-15, 1980 also included a test of the FAA's Administrative Allocation procedure. An earlier version of the same simulation was conducted at M.I.T. in December 1979 by the staff of Flight Transportation Associates (FTA). The scenario included five competing airlines and 17 airports with three of them being capacity-limited. These three airports carried about 66 percent of all the traffic in the initial schedules (base case), and there was a total of 480 flights per day in these schedules. Hourly quotas for the three capacity-limited airports were established by the game administrator based on the airport activity profiles obtained in the base case. They were 13, 12 and 11 for the three airports designated AAA, BBB and CCC respectively in the Evaluation Exercise scenario.

The five teams were assigned FTA staff members and airline participants. They were instructed to maximize short-run airline profits using a fixed fleet of aircraft and fixed fares, but free choice of routes and schedules. The schedules were assumed to operate for six months at a time.

This second volume of the Final Report on runway slot allocation by auction presents an outline of the Airline Management Game, the experimental design, the bidding rules and the results and analysis of the Evaluation Exercise. After the

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\* The terms "Slot Exchange Auction" and "slot exchange," as used in this report refer to the same objects as the earlier names "Trading Post Auction" and "aftermarket."

exercise the airline participants were invited to submit written comments and responses to FAA questions about the two methods of slot allocation and the testing procedure used for evaluating them. Their replies are included in facsimile as Section 5 of this volume.

The airline participants were given a rather large amount of scenario data--operating statistics, cost parameters, initial schedules, system route maps, etc.--and a set of instructions for bidding in each of the two allocation methods. We have not included all of this material here since most of it is covered in the report in a slightly different form, and furthermore this report deals with one of the two methods. We have tried to include all data relevant to the task of interpreting the results of the Evaluation Exercise concerning the Slot Exchange method. The results of the earlier (December) exercise are summarized in Appendix B.

## 2. TESTING CONCEPTS AND PROBLEMS

This approach is new. There is no mathematical guarantee that the <sup>^</sup>tatonnement process will converge. The circumstantial evidence is very positive, but not completely convincing. The 42 interdependent trading posts of today may well become 142 trading posts tomorrow. Can the airlines cope with this complexity? What are the effects of this complex dependency on the convergence behavior of the repeated Trading Post auction?

These are difficult questions which demand careful study and thorough experimentation.

When should the auctioning process be stopped? It seems highly unlikely that the procedure will of itself reach a point where no party wishes to change a bid--the sheer dimension of the number of trading posts would seem to admit the wish of at least one airline to change its bid at at least one trading post. A sine qua non is that the conditional outcome of any round of auction be a potential final outcome: this to ensure that each airline reveal its true demands to the extent it knows them. The threat must exist that, at any time, the hammer may fall.

The dynamics of the conditional outcomes are complex. After several rounds one may expect that many prices and allocations begin to repeat, with the "action" occurring at the margin. "Chases" may occur, with prices at one or several trading posts driving upwards as participants compete for the marginal slots at those posts. These followed by some, perhaps "too many," airlines dropping out, the demands at the corresponding posts dropping below supply. Because of the indivisible nature of the commodity it may well be necessary to impose, in such cases, a positive trading post price even in the presence of excess supply. This "threshold" price or "entrance fee" would be introduced to prevent cyclic phenomena at trading posts

(caused entirely by the indivisibility of slots): a trading post price might slowly climb in successive rounds, then suddenly drop to \$0 with several bidders dropping at once, then begin climbing again with \$0 being an attractive price to those who had dropped out, etc.

So a stopping rule must be defined. There are several candidates.

1. By convergence of price. If, in two successive rounds of bidding, the 42-dimensional trading post prices are sufficiently close to one another, stop. For example, if  $p = (p_1, \dots, p_{42})$  is one set of prices and  $p' = (p'_1, \dots, p'_{42})$  the next set and  $\max_i p_i - p'_i \leq \epsilon$ , for  $\epsilon$  some positive number defined at the beginning of the auctioning process, then stop.

2. By convergence of allocations. If, in two successive rounds of bidding, the trading post allocations to airlines are sufficiently close to one another, stop. For example, suppose airline  $i$  receives  $a_{ij}$  slots at trading post  $j$  in one round, receives  $a'_{ij}$  in the next round, and  $\max_{ij} |a_{ij} - a'_{ij}| \leq \delta$ , for  $\delta$  some small positive integer defined at the beginning of the auctioning process, stop.

3. By vote. If, at any round,  $m\%$  ( $m \geq 50$ ) of the bidders are satisfied with the conditional allocations, then stop.

4. By payment. If, after weak "convergence" by 1, 2 or 3, an airline wishes to change its bid, then it pays a fixed sum for the privilege of so doing.

5. By price-averaging. If, after several rounds of bidding have taken place, the administrator observes cyclicities in the successive trading-price vector, then the rules of price formation are changed and the conditional trading-price becomes a weighted average of past prices. For example, let  $\underline{p}^1, \underline{p}^2, \dots, \underline{p}^{k-1}$  be the trading post prices of the first  $k-1$  rounds as usually determined, and  $\underline{p}^k$  that of the  $k^{\text{th}}$  round as usually determined. Then the commissioner announces instead  $\underline{p}^k = \sum_{j=1}^k \lambda_j \underline{p}^j$ , with  $\sum_j \lambda_j = 1$  and  $0 \leq \lambda_1 \leq \lambda_2 \leq \dots \leq \lambda_k$ .

6. By successive shares. Instead of seeking convergence over the entire process, one could seek it by "successive shares." Each round of bidding results in a final but partial allocation. The first round is conducted as usual: conditional trading post prices are found. The top  $q_1$ , with  $q_1 < q$ , e.g.,  $q_1 \leq q/10$  of the bidders in a market with quota  $q$  are actually awarded the slots at the trading post price. The second round is conducted as usual, but with the quotas reduced to  $q - q_1$ : conditional trading prices are found and the top  $q_2$  (where  $q_1 + q_2 < q$ ) of the bidders in each market are again awarded the slots at the trading post price. And the procedure iterates, with the number of winners per round  $q_1, q_2, \dots, q_k$  defined in advance with  $\sum q_i = q$  and perhaps decreasing as the rounds proceed. Convergence is assured by construction. The airlines know "where" they are at any point and react accordingly. Uniform trading post prices are lost, but the ultimate allocation should be close to an economic equilibrium.



### 3. TESTING THE SLOT EXCHANGE AUCTION

#### 3.1 Background

The experimental testing of the Slot Exchange Auction poses a number of difficult problems as pointed out in the previous pages. Foremost among these is the need to have bidding which is related to airline network scheduling in a meaningful way. If the structure of slot interdependence, which we have repeatedly emphasized in this report, is not present in the experiment, the prices attached to slots will have no relationship to the airlines' valuation of slots. Since the real airline scheduling problem is immense and complex, there is a need for a simplified structure in the experiment. The Airline Management Game (AMG), developed and tested by Antonio Elias<sup>1</sup> of M.I.T. and Flight Transportation Associates, is a vehicle for providing a simplified structure of the air transportation network. It is a combination "game" and computer simulation in which the "players" make realistic airline management decisions. These decisions are fed into a computer along with CAB air traffic data, airline operations cost parameters, and air transportation block times and distances. The computer simulation allocates the passenger demand among the competing air carrier services offered by the competing "players," which in practice are teams rather than individuals. It also prints profit and loss, balance sheets, OAG-type schedules, and network and operating statistics for the game. The "players" have a chance to read the computer output, evaluate their performance in the competitive transportation scenario and revise their decisions. After some number of iterations, the results can be regarded as final.

The initial idea for an experiment to evaluate the effects of allocating slots by auction was as follows:

1. An air transportation scenario for five competing airlines would be created by Dr. Elias.
2. The "players" would be told the hourly quotas at three congested airports and required to bid in a Slot Exchange Auction for runway access slots at those airports. However, many rounds of bidding would be needed (held). A computer program would process the bids to determine slot prices and allocations at the three congested airports.
3. The AMG would be played with the slots restrictions imposed on the airlines by the auction results.
4. The Slot Exchange Auction and the AMG would be repeated at least once.

In December 1979 a trial exercise of this sort was held at the Flight Transportation Laboratory at M.I.T. It was observed by Harvey Safeer and John Rodgers of the FAA, participants were drawn from the staff of ECON and the FTA, and it was conducted over approximately five days. As a result of this trial exercise it was decided to invite airline participation in early 1980 for a slot allocation evaluation exercise using the AMG and the Slot Exchange Auction. The purposes of this were to expose some representatives of the airline industry to the allocation methodology and obtain their reactions and to evaluate the approach to slot allocation, together with an alternative administrative approach. The December trial exercise involved considerable fine tuning of the AMG and Slot Exchange Auction, and as such can be regarded as a necessary developmental step in creating the procedures, forms, computer software and rules of the game for the evaluation exercise. Neither exercise permitted convergence of the Slot Exchange Auction within the resource constraints available. There was a clearly demonstrated need to have more rounds of bidding to bring the slot market into equilibrium. Results of the trial exercise are presented in summary as Appendix B.

### 3.2 Organization

In order to evaluate two alternative methods of allocating runway access slots to air carriers at congested airports, the FAA sponsored a week-long evaluation exercise in Washington, D.C. on February 11-15, 1980. A daily schedule for this exercise was provided in advance to participants (Figure 3.1). The heart of the exercise was the Airline Management Game (AMG)--a realistic computer model which permits competing airline teams to schedule their air transportation networks, and learn the performance and financial results through simulation of the resulting traffic flows, costs, revenues, load factors, etc. There were five airline teams: Blue, Gold, Green, Red and White.

With the assistance of the Air Transport Association (ATA), management and professional staff from the airlines were invited to participate in the exercise. Those who accepted the invitation were assigned to the five teams as follows:

<u>AMG Team</u>	<u>Airline</u>	<u>Participant</u>
Blue	Delta Piedmont	W. Jeffrey Rowe Bob McAlpin
Gold	Eastern USAir	Bill Pacelli Jerry Frissora
Green	United Braniff	Ian Bamber Jim Bowers
Red	American American	Brad Jensen Don Roach
White	TWA	R. J. Zablocki

In addition each airline team was assigned a professional staff member of Flight Transportation Associates who served as an experienced user of the AMG software and provided data processing capabilities to his team. Antonio Elias of M.I.T. and the FTA was the Game Administrator.

The major purposes of the evaluation exercise were:

DAY	AM/PM	ACTIVITY
MONDAY FEBRUARY 11	0830-1000	BRIEFING--THE AIRLINE MANAGEMENT GAME
	1000-1015	BREAK
	1015-1130	BRIEFING, THE TRADING POST AUCTION
	1130-1230	LUNCH
	1230-1630	PREPARE DESIRED PERIOD 1 FLIGHT SCHEDULES
	1230-1330	OBSERVERS ONLY--BRIEFING--ADMINISTRATIVE ALLOCATION
	1630-1700	BRIEFING ACTIVITIES--FEBRUARY 12-15
TUESDAY FEBRUARY 12	0830-1200	TRADING POST AUCTION NO. 1
	1200-1300	LUNCH
	1300-1500	PREPARE FINAL PERIOD 1 FLIGHT SCHEDULES
	1500-1700	PERIOD 1 SIMULATION
WEDNESDAY FEBRUARY 13	0830-1030	PREPARE DESIRED PERIOD 2 FLIGHT SCHEDULES
	1030-1230	TRADING POST AUCTION NO. 2
	1230-1330	LUNCH
	1330-1530	PREPARE FINAL PERIOD 2 FLIGHT SCHEDULES
	1530-1700	BRIEFING--ADMINISTRATIVE ALLOCATION (SIMULTANEOUS PERIOD 2 SIMULATION)
THURSDAY FEBRUARY 14	0830-1200	ADMINISTRATIVE ALLOCATION NO. 1
	1200-1300	LUNCH
	1300-1500	PREPARE FINAL PERIOD 1 FLIGHT SCHEDULES
	1500-1700	PERIOD 1 SIMULATION
FRIDAY FEBRUARY 15	0830-1030	PREPARE DESIRED PERIOD 2 FLIGHT SCHEDULES
	1030-1230	ADMINISTRATIVE ALLOCATION NO. 2
	1230-1330	LUNCH
	1330-1430	ADMINISTRATIVE ALLOCATION NO. 2
	1430-1530	PREPARE FINAL PERIOD 2 SCHEDULES
	1530-1700	CLOSING FORUM (SIMULTANEOUS PERIOD 2 SIMULATION)

FIGURE 3.1 EVALUATION OF RUNWAY QUOTA ALLOCATION MECHANISMS--  
DAILY SCHEDULE (AS REVISED FEBRUARY 7, 1980).

1. To test the feasibility of two slot allocation mechanisms in a fairly realistic airline scheduling environment:
  - A. The Slot Exchange Auction
  - B. The FAA Administrative Allocation
2. To obtain comments from the airlines on their reactions to the two allocation methods
3. To obtain rough estimates of the economic and air service effects of slot rationing.

The two different allocation methods were evaluated by using them to allocate slots within the context of the Airline Management Game. The first on the timetable was the Slot Exchange Auction; slots were auctioned off to the competing airline teams as described in Volume I. Two days were allowed for this part of the evaluation exercise. The second method on the evaluation timetable was the Administrative Allocation, a nonprice method developed by Ken Geisinger at the FAA. It will not be described in this report. The Slot Exchange Auction was administered in the evaluation exercise by Francis Sand. Before the application of the slot allocation method, the airline teams developed their preferred schedules without consideration of slot restrictions (quotas). After examining airport activity profiles for this base case, the game and auction administrators set hourly quotas for three of the 17 airports in the scenario. The Slot Exchange Auction followed; airline teams had to bid for their slots. They were allowed to reschedule their airlines following the auction to maximize profits in the restricted game. Only those slots which they had acquired at the auction could be utilized. A similar approach was followed in relation to the Administrative Allocation. The same starting schedules and quotas were used as for the auction; accordingly it was not necessary to repeat the initial step of unrestricted scheduling.

### 3.3 The Airline Management Game

The Airline Management Game placed a team of players in the role of airline management responsible for airline scheduling and market, fleet and financial planning. The Game Administrator created a scenario for one or more competitive airlines by providing historical and forecast information on schedules, traffic, revenue, costs and airline finances, and a set of rules and objectives for the players. Each airline team developed period schedules, having determined appropriate route development, marketing strategies and fleet plans. The results of team decisions were then simulated in a computerized model which estimated the traffic and revenues and consequently the financial results for each airline.

During this exercise the objective of each airline team was to schedule its flights so as to maximize its short-run profits with a fixed fleet of aircraft. Market strategies open to individual airlines consisted of changes in schedules and routes. Schedules had to be feasible in terms of fleet size and slot allocations. No route authority was required because complete deregulation was assumed.

The heart of the game is a computerized traffic allocation process which determines the through and connecting passenger traffic on each segment of each flight. It is based on the complete services offered in all markets and is sensitive to:

- Differences in fares<sup>\*</sup>
- Differences in departure time
- Differences in flight times, including the added inconvenience of connections
- Effects of high load factors on certain flight segments.

---

<sup>\*</sup> Not used in the evaluation exercise. Fares differed by trip length, but not by discretion of the airline team.

The scenario for the evaluation exercise comprised 17 airports grouped in four major classes according to the market and traffic characteristics:

1. There were four major hubs: Alpha (AAA), Bravo (BBB), Charlie (CCC) and Delta (DDD). About half of the total network activity was made up of the traffic between these four major airports. Of these, the first three (AAA, BBB and CCC) were capacity restricted and the participants had to compete for slots at these airports.
2. There were six intermediate airports: Echo (EEE), Foxtrot (FFF), Golf (GGG), Hotel (HHH), India (III) and Juliet (JJJ). There was considerable activity between the four major airports and these six, as well as between these six airports.
3. The third group was comprised of six minor airports. There was significant traffic between these airports and the previous ten, but no traffic among these minor airports.
4. The fourth group was a single airport: X-ray (XXX). This was a special long-haul case, and there was traffic only between XXX and AAA, and XXX and BBB. There was no traffic between XXX and any other airport.

A system route map (Figure 3.2) was provided to the players.

Individual airline teams did not know exactly what the demand was in any of these markets; however, they had the existing traffic data. The game model allowed some stimulation or contraction of demand due to improvement or decrease in the level of service offered (including the case where the market is not served at all).

There were five airlines competing in this network: Blue (BL), Gold (GL), Green (GR), Red (RD) and White (WT). Each of these airlines had, during the past, a traditional pattern of service, which is reflected in the given initial schedule. Under deregulation they were free to serve any market, subject to the limitations of their available equipment. For purposes of this exercise, fares for all airlines were limited to a simple tariff of \$23.40 plus 10 cents per nautical mile (8.68 cents per statute mile).

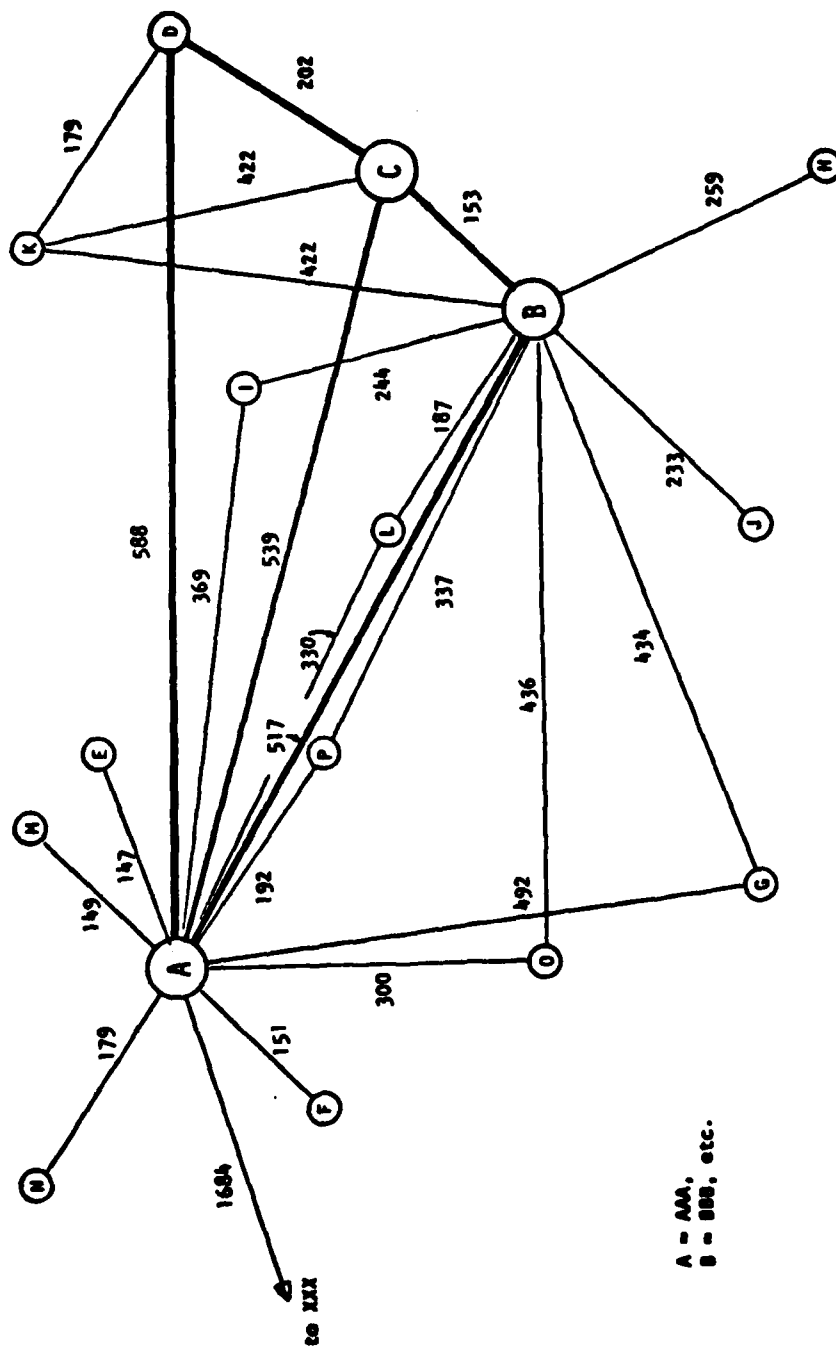


FIGURE 3.2 SYSTEM ROUTE MAP (DISTANCES IN NAUTICAL MILES)



The participants' fleets included three types of aircraft: DC9, 727 and 707. The technical and economic characteristics of each of these aircraft are summarized in Table 3.1.\* The composition of each participant's fleet was fixed as follows:

1. Blue: ten 727s and six 707s
2. Gold: eight 727s and six DC9s
3. Green: nine 727s and six DC9s
4. Red: four 727s and three DC9s
5. White: six DC9s.

It was not necessary for a team to use all of its aircraft; however, airlines incurred some daily ownership costs for all the aircraft owned, whether they flew them or not. Table 3.2 shows the distance in nautical miles between each possible pair of airports in the system, as well as the block time required to fly that particular link. This block time includes the flight time, and the average air and ground maneuvering times, including average ATC delays. The minimum gate time for a flight's intermediate stop was 20 minutes. The minimum gate time to turn around an aircraft at the end of a flight and make it ready to start a new flight was 45 minutes.

Teams could declare on-line connections. Note that the simulated passengers only took advantage of published connections (i.e., they did not generate their own connections). Table 3.3 shows the data on each airport, including the minimum connect time (the same for all airlines) at each airport.

Interline connections were not allowed.

---

\* Tables 3.1 through 3.5 are presented in the Data Appendix because they are too voluminous to include in the body of the report.

Each simulation iteration simulated a six-month period of operations. Therefore, the participants were required to maximize their short-term objectives, e.g., before-tax profit.

Tables 3.4 and 3.5 contain initial schedules for each airline and associated base period traffic data and economic performance of each airline. Separate material was provided to individual airline teams on the profitability of individual flights during the base period.

#### 3.4 Reference Material on Slot Auction Provided to Participants

The following pages contain the instructions on bidding in the Slot Exchange Auction. They are reproduced here exactly as given to the five airline teams prior to commencement of the exercise.

## Slot Auction Description and Instructions

1. Introduction

You are taking part in an experiment to determine the effects of runway slot auctions on airline scheduling and profitability. The FAA imposes hourly quotas on landings and takeoffs at the high density airports. At certain peak hours of the day, the airlines wish to schedule more flights at these airports than there are slots available under the FAA rules. In the experiment, we will simulate the slot restrictions, and an allocation of restricted slots will be made by means of an auction. A slot price will have to be paid for slots at peak hours at congested airports. The purpose of charging a price for such slots is to resolve, in an economically efficient way, the question of which airlines obtain slots when there is an insufficient supply of slots.

You will be asked to prepare bids for slots after you have completed a first cut at desired schedules without slot restrictions. The method of bidding and the determination of slot prices and allocations will be explained in detail below. After you have submitted bids for all the slots (at all quota-airports) that "interest" you, a computer program will determine an allocation and a single price for slots at each peak hour at each congested airport. The price may be nominal--this happens if the number of slots requested in all the bids for one airport at one peak hour is less than the FAA quota. The auction results are not necessarily final. You may study them and prepare new bids if you wish,

providing the auctioneer has not closed the auction market. On the first round of bidding you can be assured of another chance to bid; therefore, you will get a chance on the second round to correct "mistakes" in bidding which may arise due to unfamiliarity with this type of auction.

## 2. The Auction Procedure (Trading Post Method)

To introduce the concept of the auction we ask you to imagine that there are a number of trading posts at which slots are offered for sale--one for each peak hour at each congested airport. All these trading posts will be open simultaneously. Airlines wishing to buy one or more slots at particular trading posts prepare bids (offers to pay a specified amount of money) for these slots as follows:

<u>Airline A</u> <u>Trading Post "i"</u>	Bid (\$/opr)	Slot Number				
		1	2	3	4	5
		150	100	100	70	0

This means that airline A is offering to pay \$150 for one slot,\* \$100 for each of the second and third slots and \$70 for a fourth slot at trading post "i," at a specific hour at a specific airport. If awarded one to four slots, it will pay the announced price which will not exceed the bids. Suppose a slot price of \$95 is announced. Then airline A will be awarded 3 slots at \$95--the fourth slot, for which only \$70 was bid, is not awarded to A.

---

\* A slot is defined as a right to conduct one runway operation within a 60-minute period at a designated airport every day for six months. Pricing is expressed in dollars per operation. The actual payment for slots awarded will be price times 182.

The bidding rules are as follows:

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1. Airlines prepare their bids privately.
2. Airlines bid for as many slots as they wish at all trading post simultaneously.
3. When the auctioneer closes the auction at any time after the first round of bidding, the airlines must accept and pay for the slots awarded them. Slot prices will never exceed bids for slots actually awarded, and frequently will be substantially lower. The payment schedule for slots awarded may be spread out, interest-free, over the six months of slot utilization.
4. If more than one bid is made at the slot price, but the quota is such that not all bids at that price or higher can be awarded, then a random allocation is used to determine which among the airlines bidding the slot price are awarded slots.
5. At the end of each round of bidding, the slot prices and allocations are computed and all airlines are informed of the results. If this is not the last round, they may study the computer results and make any changes they wish in their bids, subject to the rules.
6. There is no need to resubmit unchanged bids as these are stored in computer memory. Only those bids which are to be

changed in any way need be submitted, and these must be submitted in full. Thus, if the bid was originally:

<u>Airline A, Round 1</u> <u>Trading Post "i"</u>	Bid (\$/opr.)	Slot Number				
		1	2	3	4	5
		150	100	100	70	0

and the \$ amount for the second slot is to be increased to \$125 and this is the only change, the resubmission should be:

<u>Airline A, Round 2</u> <u>Trading Post "i"</u>	Bid (\$/opr.)	Slot Number				
		1	2	3	4	5
		150	125	100	70	0

7. After completion of two or more rounds of bidding, the auctioneer may determine when to close the auction. Once the auction has been closed, no further bidding for slots will be accepted. The auction will be closed if the players vote unanimously to discontinue bidding, or if the auctioneer determines that the slot allocation has "settled down" sufficiently.

### 3. Explanation of Price Determination

The bids prepared by airlines (See Figure 1) for slots at each trading post represent, in effect, the individual demand schedules of the airlines. When all the airlines have bid, the bids are aggregated into market demand curves for slots at each trading post (See Figure 2). The FAA hourly quota causes the supply of slots to be restricted, so that a supply curve for slots is generated with zero price for slots under the quota, and a very high price\* for

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\*effectively infinite

slots above the quota. Supply and demand are in balance if the 20  
price is set at the intersection of the supply and demand curves  
(See Figure 3). The solution technique is displayed in Figure 3 for  
the same example presented in Figure 1 and we see that the slot  
price in this example is \$65. Because these curves are step  
functions, and the quantity of slots must be an integer, there is a  
slight ambiguity about the intersection which is resolved by taking  
the midpoint of the range of slot prices around the balance point of  
supply and demand. In other cases, the ambiguity may result in two  
or more marginal slots for which the same amount was bid having to  
be allocated randomly to airlines. For example, if A and D, had  
both bid \$80 for their third and fourth slots respectively, only one  
of these slots could have been awarded; which one would be decided  
by the "toss of a coin".

Ordinarily, when supply is in excess, the absence of demand  
pressure will allow the slot price to be zero. However, a minimum  
price will be announced and charged for all allocated slots.  
Whenever there is excess demand, however, a positive price is  
necessary in order to eliminate some of the demand. The price is  
chosen so that all airlines which bid above that price are awarded  
slots, all who bid below are not. In a subsequent round of bidding,  
the disappointed airlines have a chance to bid higher, so as to try  
to capture desired slots. This causes the slot price to go up so  
that there will be a new allocation of slots at the next round.  
Some airlines may find they have lost slots which were previously

FIGURE 1. SUMMARY OF ALL AIRLINE BIDS  
FOR ONE TRADING POST  
(UNITS = \$ PER OPERATION)

AIRLINE	SLOTS (QUOTA = 11 PER HOUR)						ALLOCATION
	1	2	3	4	5	6	
A	100*	90*	50	0			2
B	150*	150*	150*	100*	50	0	4
C	100*	0					1
D	110*	100*	90*	80*	0		4
E	49	49					0

\*INDICATES SUCCESSFUL BID



FIGURE 2. FORMATION OF PRICE, SLOT ALLOCATION AT A TRADING POST

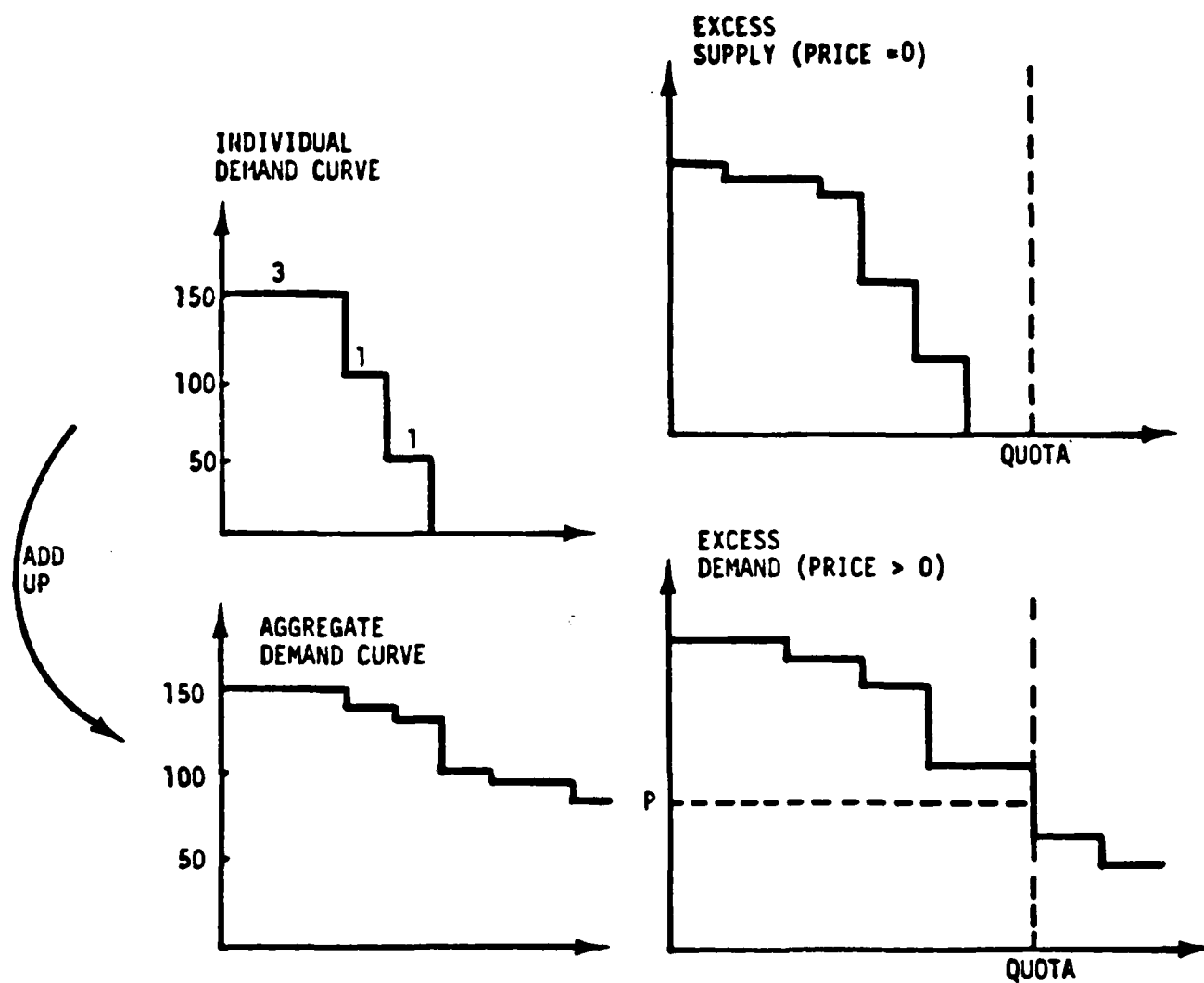
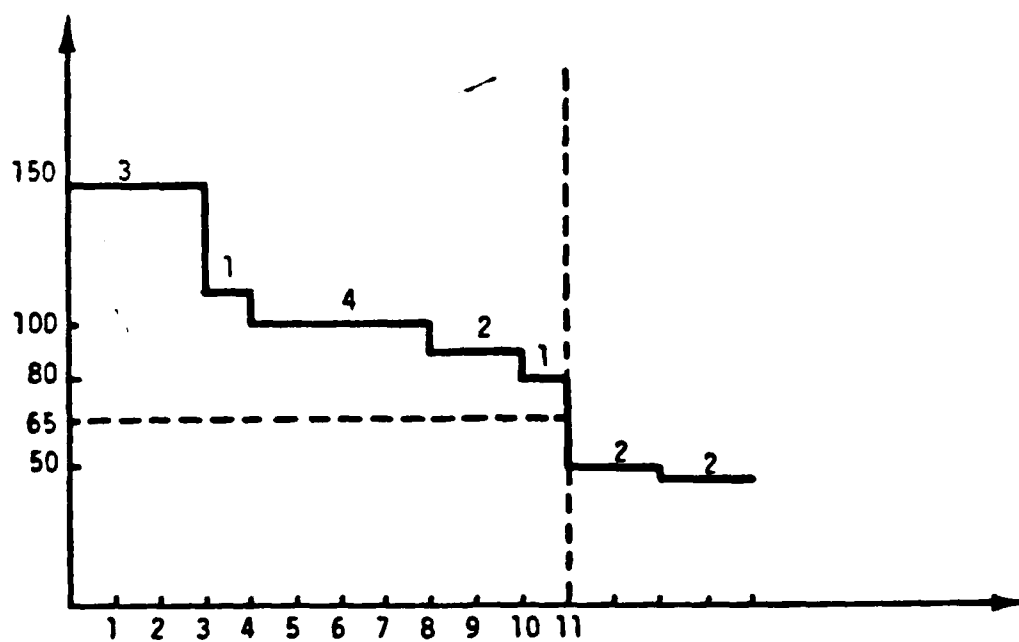


FIGURE 3. AGGREGATED DEMANDS FROM ALL AIRLINE BIDDING AT ONE TRADING POST



AGGREGATED DEMANDS FROM BIDDING AT TRADING POST

won. In addition to bidding higher amounts to recapture these lost<sup>24</sup> slots, the airlines should consider "sliding" to an adjacent market. Eventually the process converges to a competitive equilibrium. In practice the auctioneer must determine when the bidding has "settled down" sufficiently and announce a cut-off, as described in the Rule No. 7 above. If the available auction time runs out with the allocation still fluctuating, then it will be necessary to halt the simulated auction. In reality, it will be desirable to resume bidding the next day in any future implementation of the slot auction.

4. Scheduling Flights After Slot Allocations To Airlines.

Following the slot auction, each airline will have received a printout containing detailed information on the slots awarded to itself, and payments required over 6 months operations for those slots. It will be the responsibility of each airline to make sure that flights scheduled subsequently are compatible with the slot allocation at capacity restricted airports. An airline awarded five slots at 9:00 a.m. at airport AAA is therefore expected to schedule no more than 5 runway operations at that airport from 9:00 a.m. to 9:59 a.m. The game administrator will also check the schedules for slot feasibility and inform airlines of any violation.

#### 4. RESULTS AND ANALYSIS

The exercise was conducted in five offices, one for each airline team, and a control center for the game administrators on the ninth floor of the FAA building at 800 Independence Avenue. The airline schedulers, the game administrators and the members of the FAA's Office of Aviation Policy who were involved all put in long hours. A large amount of learning of game procedures and sifting through scenario airline data was required of the airline schedulers. Considering this and the time pressures, the evaluation exercise was conducted reasonably close to the daily schedule and with a number of useful results.

First, the exercise showed that it was possible to operate profitably in the simulated slot-restricted environment, allowing for the new cost element when the slots were priced. Secondly, the results indicated that the airline teams were able to prepare bids and acquire a usable set of slots through the Slot Exchange Auction. Thirdly, the results showed that some of the teams were able to make even better profits within the restricted environment than they did in the base case; other teams gave up some profits to slot payments. The improvement of airline profitability in the face of increased costs due to slot pricing shows a learning effect.

Procedurally, the Slot Exchange Auction was found to work satisfactorily within the time constraints of the exercise. Due to these constraints, there was only a partial test of the equilibrium concept, and indeed many more rounds of bidding would seem to be required. The slot awards demonstrated remarkable convergence, but price convergence remains to be shown. In the previous section some alternative methods of guaranteeing termination were discussed.

#### 4.1 The Slot Exchange Auction Results

Because of the large amount of data generated by the slot allocation evaluation, this section will necessarily be selective in presenting the results. The complete body of the airline management game output and auction evaluation output will be made available on request. Table 4.1 presents the "bottom line" for each phase of the evaluation: the net earnings (after tax) of the five airline teams. In the case of the second and third lines of Table 4.1 these figures are also net of slot payments resulting from the auctions. The "industry" as a whole proved able to generate as much profit after suitable learning with an auction for slots (line 3) as it did without the auction (line 1); indeed, without any restrictions as to slot utilization. Individual teams either improved their profitability (Blue and Red) or managed to avoid serious losses (Gold, Green and White), again after suitable learning. The large loss generated by the Blue team in Period 1 is anomalous and was corrected in Period 2; it was caused by an excessively simplistic market strategy on the part of the Blue team, leading to severe drop in load factors.

The quotas were set by the game administrator and auctioneer as being:

Airport	A	B	C
Quota	13	12	11

at the end of the base period. Tables 4.2 through 4.11 summarize the financial and performance results of the evaluation exercise. Starting with Tables 4.2 through 4.4 we find that slot prices within the first period Slot Exchange auction tend strongly upwards at the most favored peak hours, particularly at airport C which had the smallest quota. The exceptionally high slot prices at 0800 and 1600 hours at airport A (implying slot payments of respectively \$141,232 and \$128,674 per season by each airline scheduling arrivals or departures at those hours) are indicative of overbidding in the first period auction. This was corrected in the

**TABLE 4.1 NET EARNINGS\* BEFORE AND AFTER SLOT ALLOCATIONS  
(IN MILLIONS OF DOLLARS PER SIX-MONTH PERIOD)**

CASE	AIRLINE					
	BLUE	GOLD	GREEN	RED	WHITE	ALL
1. BASE	-0.220	3.817	3.845	1.109	4.018	12.569
2. PERIOD 1--AUCTION**	-7.967	3.098	1.634	0.485	3.183	0.433
3. PERIOD 2--AUCTION**	1.349	3.254	3.445	1.426	3.691	13.165
4. PERIOD 1--ADMINISTRATIVE	2.020	4.282	3.849	1.656	3.892	15.699

\*AFTER TAX  
\*\*AFTER SLOT PAYMENTS AND INCOME TAXES

**TABLE 4.2 SLOT PRICES AT END OF ITERATION 1.1  
(DOLLARS PER OPERATION)**

HOUR	AIRPORT		
	A	B	C
0600	0	0	0
0700	100	7	7
0800	200	0	8
0900	8	0	50
1000	8	7	100
1100	54	8	38
1200	79	125	4
1300	200	8	8
1400	29	0	100
1500	29	38	100
1600	200	1	4
1700	104	4	54
1800	129	25	58
1900	4	125	8
2000	1	0	7
2100	0	0	0
2200	0	0	0

TABLE 4.3 SLOT PRICES AT END OF ITERATION 1.2 (DOLLARS PER OPERATION)			
HOUR	AIRPORT		
	A	B	C
0600	0	0	0
0700	202	4	8
0800	860	0	8
0900	101	0	101
1000	30	12	151
1100	78	13	0
1200	251	201	0
1300	311	51	51
1400	101	0	251
1500	0	76	201
1600	432	1	0
1700	180	0	403
1800	201	51	210
1900	8	201	18
2000	0	0	51
2100	0	0	0
2200	0	0	0

TABLE 4.4 SLOT PRICES AT END OF ITERATION 1.3 (DOLLARS PER OPERATION)			
HOUR	AIRPORT		
	A	B	C
0600	0	0	0
0700	276	4	0
0800	776	1	58
0900	209	1	209
1000	51	0	485
1100	0	0	0
1200	301	301	0
1300	351	204	209
1400	197	0	429
1500	0	201	501
1600	707	5	0
1700	201	0	510
1800	0	351	458
1900	0	155	51
2000	0	0	0
2100	0	0	0
2200	0	0	0

TABLE 4.5 POTENTIAL SLOT REVENUES (MILLIONS OF DOLLARS PER HALF-YEAR SEASON)				
ITERATION AND ROUND	AIRPORT			
	A	B	C	ALL
1.1	2.709	0.760	1.093	4.562
1.2	5.809	1.332	2.909	10.050
1.3	7.261	2.671	5.826	15.758
2.1	1.051	0.646	1.269	2.966
2.2	0.582	0.535	1.922	3.039
2.3	2.432	0.937	3.934	7.303

**TABLE 4.6 NET EARNINGS BEFORE TAXES OR SLOT PAYMENTS  
(IN MILLIONS OF DOLLARS PER HALF-YEAR  
SEASON)**

AIRLINE	BASE*	PERIOD	
		1	2
BLUE	-0.22	-2.11	3.00
GOLD	3.82	10.14	7.23
GREEN	3.84	7.25	7.66
RED	1.11	2.48	3.17
WHITE	4.02	9.07	8.20
ALL	12.57	26.84	29.26

\*THERE WERE NO SLOT RESTRICTIONS IN THIS INITIAL ITERATION.

**TABLE 4.7 POTENTIAL SLOT PAYMENTS AFTER EACH BIDDING ROUND  
(MILLIONS OF DOLLARS PER HALF-YEAR)**

AIRLINE	PERIOD AND ROUND					
	1.1	1.2	1.3	2.1	2.2	2.3
BLUE	1.843	3.574	5.971	0.921	0.641	1.778
GOLD	0.158	2.079	3.047	0.843	0.959	2.410
GREEN	1.823	2.135	3.617	0.395	0.725	2.034
RED	0.034	0.889	1.019	0.371	0.318	0.185
WHITE	0.703	1.372	2.104	0.436	0.397	0.886
ALL	4.561	10.049	15.758	2.966	3.040	7.303

**TABLE 4.8 NET EARNINGS AFTER SLOT PAYMENTS, AFTER TAXES  
(MILLIONS OF DOLLARS PER HALF-YEAR)**

AIRLINE	BASE	PERIOD	
		1	2
BLUE	-0.220	-7.967	1.349
GOLD	3.817	3.098	3.254
GREEN	3.845	1.634	3.445
RED	1.109	0.485	1.426
WHITE	4.018	3.182	3.691
ALL	12.569	0.432	13.165



second period auction as can be seen by referring to Table 4.5. Total slot payments at the end of Round 3 of the bidding in the first period amounted to nearly \$16 million per season, which exceeded net earnings (\$12.5 million) of all five airline teams in the base period (Table 4.6). The airline teams were nevertheless able to increase net earnings in Period 1 so that, even with the high cost of slots, they managed to break even (Table 4.8).\*

There were significant reductions in slot prices and improvement in profitability during Period 2. The aggregate level of slot payments was less than half the Period 1 level after three rounds of bidding. Net earnings before taxes were up sharply and the final Period 2 profitability was actually better with slot pricing than it had been without slot pricing in the base period (Table 4.8). A learning effect on the part of the team players is clearly in evidence and explains this strange result. It is therefore very important to allow for airline learning in planning to implement a slot auction. The Slot Exchange auction is specifically designed to allow learning about slot market effects to take place without imposing real costs on the airline industry. More than three rounds of bidding would probably be required in implementation of the Slot Exchange auction to complete the information exchange between airlines that occurs through observing slot prices and slot allocation sequentially.

#### 4.2 Levels of Service

In reviewing the results of the evaluation exercise, it is necessary to recall that the five teams had complete freedom to determine which markets they would

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\* As previously mentioned, the Blue team suffered severe losses in Period 1.

serve subject to the constraints of their given equipment. Due to time pressures, not all of the participants were able to take full advantage of this freedom. Nevertheless, we do see considerable improvement over the initial schedules which were prepared by Flight Transportation Associates in Period 1. Further progress is in evidence in the Period 2 results. Undoubtedly, the fact that the airline participants were professional schedulers contributed to the improved airline schedules. That this improvement occurred in the face of slot restrictions which were not applied in the initial scheduling makes the result more striking.

#### 4.2.1 The System Responses

The operating statistics for the base period and Period 1 and Period 2 are presented in Tables 4.9 through 4.11. The OAG schedules, as printed on the computer by the Airline Management software, are presented in Table 4.12\* (Period 1) and Table 4.13 (Period 2). Traffic data are also generated by the AMG software; these are shown in Table 4.14 (Period 1) and Table 4.15 (Period 2).

The operating statistics (Tables 4.9 through 4.11) show considerable stability. While average load factors actually improved in Period 2 for three of the airline teams and were hardly changed for the other two, there is an overall appearance of very little change in airline operating statistics if one compares Period 2 (Table 4.11) with the base period (Table 4.9). The difficulties encountered in Period 1, such as Blue's 10.8 percent drop in load factor, can all be attributed to learning. The main conclusion which we draw from the evaluation exercise is that the airlines can perform "business as usual" in the face of slot pricing and can maintain their profitability. Caution is required in extending this conclusion to the real air transportation system; in allowing the players complete freedom of choice

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\* On account of their large bulk, Tables 4.12 through 4.15 are presented in the Data Appendix.

TABLE 4.9 OPERATING STATISTICS--BASE CASE

	BLUE	GOLD	GREEN	RED	WHITE	ALL
SEAT-MILES ( $\times 10^6$ )	1,407.7	887.0	1,090.1	378.8	309.7	4,073.2
RPM ( $\times 10^6$ )	781.6	558.0	651.7	180.0	215.5	2,386.8
ENPLANEMENTS ( $\times 10^6$ )	1.665	1.200	1.278	0.500	0.493	5.137
AVG. EQUIPMENT UTILIZATION (HRS/DAY)	10:08	9:07	10:08	8:08	9:41	9:36
AVG. STAGE LENGTH (MILES)	453	401	454	355	370	420
AVG. LOAD FACTOR	0.555	0.629	0.598	0.475	0.696	0.586

TABLE 4.10 OPERATING STATISTICS--PERIOD 1

	BLUE	GOLD	GREEN	RED	WHITE	ALL
SEAT-MILES ( $\times 10^6$ )	1,521.8	900.2	963.1	412.4	309.7	4,107.1
RPM ( $\times 10^6$ )	752.5	582.5	561.9	183.8	215.0	2,295.8
ENPLANEMENTS ( $\times 10^6$ )	1.383	1.202	1.172	0.490	0.510	4.757
AVG. EQUIPMENT UTILIZATION (HRS/DAY)	10:19	9:09	8:51	8:17	9:41	9:21
AVG. STAGE LENGTH (MILES)	572	426	477	369	370	461
AVG. LOAD FACTOR	0.495	0.647	0.583	0.446	0.694	0.559

TABLE 4.11 OPERATING STATISTICS--PERIOD 2

	BLUE	GOLD	GREEN	RED	WHITE	ALL
SEAT-MILES ( $\times 10^6$ )	1,309.1	913.7	1,000.1	394.8	314.6	3,931.3
RPM ( $\times 10^6$ )	722.9	590.4	610.8	190.4	219.7	2,334.3
ENPLANEMENTS ( $\times 10^6$ )	1.348	1.236	1.313	0.482	0.520	4.899
AVG. EQUIPMENT UTILIZATION (HRS/DAY)	9:11	9:21	9:19	8:08	9:52	9:12
AVG. STAGE LENGTH (MILES)	529	416	459	383	361	443
AVG. LOAD FACTOR	0.552	0.646	0.611	0.484	0.699	0.594

with regard to routes and market strategies we have undoubtedly exaggerated the extent to which airlines would change their network in response to slot pricing and allocation.

One advantage of the real situation is that over several six-month periods the equilibrium of slot supply and demand may be easier to obtain due to the inherent stability of the air transport system over time. The existence of previous prices and slot allocations will speed up the convergence of the Slot Exchange auction. In the exercises there was no such history of prices to guide the players and the equilibrium was accordingly harder to obtain.

#### 4.2.2 Service to Small Communities

The six minor airports in the evaluation exercise were KKK, LLL, MMM, NNN, OOO and PPP. Together, they had only 5.75 percent of all traffic (passengers enplaned per day) in the base case and each individual market involving a small community had less than 1 percent of all traffic. In contrast, the AAA-CCC market claimed 8.59 percent of passenger traffic. It should be noted that the simulated demand for air service did not allow for any traffic among these six airports. After the Period 1 auction, the rescheduled network showed an overall drop of 49 percent in these small markets (Table 4.16). Service to and from airports OOO and PPP was dropped entirely. Only KKK, of the six minor airports, did not lose significantly. Following the Period 2 auction, some of the small community service was restored--mostly for MMM and NNN. Two airports, OOO and PPP, still had no service. This remained true after the Administrative Allocation even though overall traffic from the six small airports was slightly up (Table 4.16) relative to the Period 2 auction.

TABLE 4.16 SMALL COMMUNITIES AVERAGE ENPLANEMENTS/DAY				
AIRPORT	BASE	PERIOD		
		1	2	AA
KKK	500.2	469.6	470.2	536.2
LLL	255.2	78.8	96.8	98.2
MMM	231.8	69.8	219.9	219.8
NNN	273.8	156.7	279.8	278.4
OOO	94.5	--	--	--
PPP	172.6	--	--	--
TOTAL	1,528.1	774.9	1,066.7	1,132.6
REL. CHANGE COMPARED WITH BASE		-49.3%	-30.2%	-25.9%

#### 4.3 The Slot Exchange (Aftermarket)

The aftermarket was organized as an openbook exchange. The players could bring written offers to buy or sell specific (time-of-day) slots at specific capacity-restricted airports (AAA, BBB or CCC) to the exchange. These offers were posted immediately on a blackboard. The forms for making such offers (to sell) or bids (to buy) are shown in Figures 4.1 and 4.2. The aftermarket administrator attempted to match sells with buys at each airport and time of day. Those slots which had not been purchased in the Slot Exchange Auction (unclaimed slots) were offered on a first come-first served basis at a nominal price of one dollar. Buyers of unclaimed slots were limited to four slots per team each 15 minutes so long as the exchange remained open and the desired slots were still available.

The activity on the exchange was not extensive. Far more offers to sell slots occurred than bids to buy slots, and the number of transactions, other than





TABLE 4.17 AFTERMARKET ACTION--PERIOD 1

TRANSACTION	AIRPORT	TIME	BUYER*	SELLER*	PRICE** (\$/OPR.)
1	CCC	21	BL		1
2	CCC	21	BL		1
3	CCC	21	BL		1
4	CCC	21	BL		1
5	AAA	15	GL		1
6	BBB	17	GL		1
7	CCC	12	GL		1
8	AAA	11	WT		1
9	BBB	10	WT		1
10	CCC	7	WT		1
11	AAA	18	WT		1
12	AAA	6	GR		1
13	AAA	11	GR		1
14	BBB	17	GR		1
15	CCC	12	GL		1
16	AAA	6	GR		1
17	CCC	11	RD		1
18	CCC	11	RD		1
19	CCC	16	RD		1
20	CCC	16	RD		1
21	CCC	8	GL	BL	116
22	CCC	13	GL	BL	418
23	AAA	14	GL	WT	394
24	BBB	14	GL		1
25	AAA	20	GL		1
26	AAA	15	GL		1
27	AAA	22	BL		1
28	BBB	21	BL		1
29	BBB	21	BL		1
30	CCC	19	RD	WT	102
31	CCC	20	GL		1
32	AAA	10	GL	BL	158
33	AAA	19	RD	WT	50
34	BBB	20	GL		1
35	BBB	11	GL		1
36	CCC	21	RD		1
37	BBB	22	RD		1
38	AAA	6	RD		1
39	BBB	10	RD	WT	50

\* TEAMS IDENTIFIED BY TWO-LETTER CODE ARE: BL=BLUE, GL=GOLD, GR=GREEN, RD=RED, WT=WHITE.

\*\* A ONE-DOLLAR PRICE WITH NO SELLER IDENTIFICATION DENOTES A PURCHASE OF AN UNCLAIMED SLOT FROM THE SLOT AUTHORITY.



TABLE 4.18 AFTERMARKET ACTION--PERIOD 2

TRANSACTION	AIRPORT	TIME	BUYER*	SELLER*	PRICE** (\$/OPR.)
1	CCC	17	RD		1
2	CCC	15	RD		1
3	CCC	7	GL		1
4	AAA	14	GL		1
5	AAA	15	GR		1
6	BBB	10	WT		1
7	AAA	12	WT		1
8	CCC	14	WT	BL	300
9	CCC	12	GR	GL	150
10	AAA	12	GL		1
11	AAA	8	GL		1
12	AAA	8	GL		1
13	AAA	8	GL		1
14	CCC	12	RD	WT	75
15	AAA	12	GR	GL	50
16	CCC	11	RD	GL	150
17	CCC	12	RD	BL	50
18	CCC	10	RD	WT	250
19	BBB	22	GL		1

\* TEAMS IDENTIFIED BY TWO-LETTER CODE ARE: BL=BLUE, GL=GOLD, GR=GREEN, RD=RED, WT=WHITE.

\*\* A ONE-DOLLAR PRICE WITH NO SELLER IDENTIFICATION DENOTES A PURCHASE OF AN UNCLAIMED SLOT FROM THE SLOT AUTHORITY.

TABLE 4.19 SLOT PAYMENTS IN AUCTION AND AFTERMARKET (\$ PER DAY)

AIRLINE	PERIOD 1			PERIOD 2		
	AUCTION TOTAL	PURCHASES	SALES	AUCTION TOTAL	PURCHASES	SALES
BL	32,806	7	692	9,823	0	350
GL	16,742	1,096	0	13,241	7	350
GR	19,875	4	0	11,177	201	0
RD	5,601	209	0	1,020	527	0
WT	11,559	4	596	4,866	302	325

the \$1.00 purchases, fell short of the number of offers by an order of magnitude (Tables 4.17 and 4.18). The total slot payments by all teams for exchange activities are shown in Table 4.19, also indicating the small volume of activity when compared with the total auction slot payments.

The airlines apparently did not behave speculatively in the slot auction and exchange, but many auction acquisitions were in excess of slot requirements as evidenced by the pressure to sell in the exchange. Some airline players informed us that they were attempting to buy "insurance" slots for important flights--slots at adjacent hours in the same airport. This may account for the excess supply in the exchange.

In a real exchange there undoubtedly would be more activity because of the six months duration of each period in real time compared with approximately two hours in simulated time. Furthermore the changing environment in the real air transportation system might necessitate slot exchanges and the pricing of such slots might not be an important consideration to the airlines. Naturally, this would change if any tendency towards speculation in slots developed.

## 5. COMMENTS BY THE AIRLINES

Those airlines which sent participants to the Evaluation Exercise in Washington, February 11-15, 1980, were invited to comment in writing. During March 1980 the participants were mailed a document of game results and ECON's and the FAA's brief analyses of these results.<sup>2</sup> They were asked to respond promptly to the following questions.\*

1. Which method did you prefer--the Trading Post Auction or the Administrative Allocation? Why?
2. In each of the two methods did you significantly alter your airline marketing approach as a result of the slot allocation? If so, in what way?
3. Do you consider the two methods to be fair? If not, in what way are they unfair?
4. Were you able to handle the total information flow comfortably in the time available in each method? Was more time required (a) for rescheduling, (b) for bidding, and/or (c) for submitting preference plans in the Administrative method?
5. Was the evaluation exercise sufficiently realistic to allow conclusions to be drawn from the real world? If not, how would you make it more realistic?
6. Assuming one had to implement one of the two alternative allocation methods, what changes would you recommend in each method to make it more practical?

Their responses are reproduced here in facsimile; they speak for themselves and hence we shall not discuss them other than to state that the factual errors which W. Jeffrey Rowe points out were corrected in this report.

- American Airlines - Donald F. Roach and R. Bradley Jensen
- Delta Airlines - W. Jeffrey Rowe
- Eastern Airlines - W. H. Pacelli

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\* Note that "Trading Post Auction" was the term then in use for the Slot Exchange Auction.

- Piedmont Airlines - R. L. McAlphin and R. L. James
- Trans World Airlines - R. J. Zablocki
- USAir - Jerry A. Frissora

# American Airlines

42

April 2, 1980

Mr. John M. Rodgers  
Acting Chief, Economic Analysis Branch  
Federal Aviation Administration  
800 Independence Avenue, S. W.  
Washington, D. C. 20591

Dear Mr. Rodgers:

By letter dated March 7, 1980, you forwarded to us an evaluation of the slot allocation exercise conducted during the week of February 11 at the FAA (the "Evaluation"). This allocation exercise explored two methods of allocating airport slots: an auction system and an administrative allocation system. On January 15, 1980, American submitted detailed comments on the auction system proposed by the Polinomics Research Laboratories. The general principles addressed in those comments apply as well to the present Evaluation. We have the following additional comments in connection with the two systems analyzed in the Evaluation:

I. BOTH THE AUCTION SYSTEM AND THE ADMINISTRATIVE ALLOCATION SYSTEM WERE BASED ON TWO INVALID PREMISES.

The Evaluation concluded that the airline teams were able to show considerable profit improvement under both the auction system and the administrative allocation system, and implies that this improvement was due to the institution of slot allocation. However, the mock airlines that the exercise participants were asked to manage were initially

operating at very low capacity utilization. The participants were able to dramatically increase the efficiency of the mock airlines simply by streamlining aircraft utilization and scheduling. The institution of the allocation methods clearly had nothing to do with the increased profits.

The Evaluation was cognizant of the problem\*, but failed to recognize the degree to which the problem affected the results. The impact of this fundamental deficiency on the overall conclusion regarding the two allocation methods cannot be lightly swept aside. Under both methods, the improvements in profitability were clearly a function of common sense resource allocation, not the institution of allocation systems.\*\* In the real world, airlines already operate at very high efficiency levels. It is simply not realistic to expect that an auction system would generate enough of an increase in efficiency to offset the cost of slot payments.

The second invalid premise of the auction and the

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\* Evaluation, pp. 16, 40.

\*\* For example, the first action the red team took in response to the slot limitations imposed was to cancel the flights which were making the least profit. Because the profits were calculated using variable cost (i.e. direct operating and passenger related costs, but no depreciation and amortization) naturally the rate of return would go up. In the real world, however, the cost of aircraft ownership cannot be disregarded.

administrative allocation systems is that they both assume that airlines have complete flexibility to alter schedules at will. This is obviously not the case. A schedule change at one airport has a ripple effect which would impact all of the subsequent segments served by the affected flight. Furthermore, passengers have come to rely on, for example, American's 6:00 p.m. flight from LaGuardia to O'Hare. Airlines are therefore not free to capriciously revamp their schedules in order to accommodate a particular allocation method. Safeguards must be built into the system to avoid inconvenience to the traveling public.

## II. THE AUCTION SYSTEM FAILED TO PRODUCE AN EQUILIBRIUM.

From an economic efficiency point of view, the auction was suppose to produce a supply/demand equilibrium that would accurately reflect the value of a given slot. However, in the auction that was conducted there was no convergence of the supply and demand curves to an equilibrium point. This appears to have been caused by the amount of uncertainty and speculation involved in the bidding process. Because the slots won in a given round of the auction were not guaranteed to the next round, it was usually necessary to increase the bid for a slot already won in a previous round. In subsequent rounds, it sometimes became prudent to drop a slot that

had been won in a previous round. Speculation and lack of convergence put an artificial upward pressure on prices. But since the auction was terminated after only three rounds, it was not possible for slot prices to reach a true supply/demand equilibrium.

### III. THE ADMINISTRATIVE ALLOCATION METHOD SIMPLY DID NOT WORK.

The administrative allocation procedure was a two-step process where each carrier was awarded a specific number of slots according to an entitlement formula, and then slot assignments were made by a computer after each carrier had submitted a number of alternative plans specifying the hour by hour utilization of its awarded slots.

Both steps in this process are flawed. First, the weights in the entitlement formula were very arbitrary and cannot be shown to favor all carriers equally at all airports. As a result of this, carriers would end up tailoring their schedules to serve the entitlement formula, rather than to serve passenger convenience. For example, some carriers may run through plane service at a particular airport while others make turnarounds. In order to maximize the number of slots to which they would be entitled under the formula, carriers operating through plane service would find it beneficial to publish all of their multi-stop service as



connections in order to achieve the greatest number of enplanements. This would create unnecessary passenger inconvenience. Moreover, it is doubtful that the interested parties would ever be able to agree on fair definitions and weightings in the entitlement formula.

The most significant drawback of the administrative allocation procedure is that the computer program employed to find the solution did not, in fact, find the solution. The carriers were asked to submit a number of different scheduling alternatives which, as discussed above, they simply do not have the flexibility to do. Nevertheless, the computer program could not find a suitable hour by hour allocation to meet the carriers' needs. Since the computer was able only to make a partial allocation, it was necessary to get all the team players into a large room with the slot requests posted on a board and then solicit volunteers for sliding. This is precisely what the scheduling committee already does.

The failure of the computer program to find a suitable allocation for all carriers is a function of the inability of the system to focus on specific problem areas. In practice, the slot allocation problem is really a peculiar combination of events occurring at specific times. It is unrealistic to expect the computer to arrive at an acceptable solution merely by presenting it with a myriad of random slot

plans. This approach did not work during the FAA exercise and it will not work in the real world. Specific individual adjustments to resolve specific problem areas are always going to be necessary.

#### IV. A SUPERIOR ALTERNATIVE TO THE CURRENT SCHEDULING COMMITTEE SYSTEM HAS STILL NOT BEEN FOUND.

In its January 15, 1980 comments to the FAA and the CAB in connection with the Polinomics study, American set forth several reasons why the current committee system should be maintained in the absence of a superior alternative. Neither of the approaches explored in the February 11 FAA exercises proved to be superior. The committee system permits intelligent interaction on specific problem areas without going back to square one each time. This is the essence of the committee system and it is why the committee system works. Neither the auction system nor the administrative allocation system has been demonstrated to more equitably or efficiently accomplish what the committee system already accomplishes.

#### V. RECOMMENDATIONS


In its Polinomics study comments to the FAA and the CAB, American set forth several considerations regarding an auction-type system. These included recommendations that all slots should be auctioned (including general aviation and

small cities slots), that slot auctions should cover a six-month period and be held six months ahead of time, and that an open, multi-step auction process would be preferable. Any auction system that may ultimately be adopted must take into account these basic considerations.

Clearly, the two systems explored during the February 11 FAA exercises did not meet the desired objectives. Neither exercise can be considered to have tested the respective systems sufficiently for application to the real world. In fact, the only concrete conclusion that can be drawn is that neither system worked. It is again urged that current scheduling committees be maintained in order to avoid disruption of a process that effectively offers the traveling public the convenience it requires.

Very truly yours,

  
Donald F. Roach  
Manager - Scheduling Systems  
Development

  
R. Bradley Jensen  
Manager - Schedule Planning

COMMENTS OF W. JEFFREY ROWE ON FAA SLOT ALLOCATION EVALUATION

W. Jeffrey Rowe  
Analyst - Economic Research  
Department 973  
Delta Air Lines, Inc.  
Hartsfield Atlanta International  
Atlanta, Georgia 30320

### GENERAL COMMENTS

The FAA is to be commended for its bold venture into assessment of policy options by computer simulation techniques. In my opinion, this type of analysis can offer valuable insight and a broader understanding of what proposed changes in the national air transportation system will accomplish. Nevertheless, this simulation exercise was flawed, as any such initial effort is bound to be. These flaws are detailed in the sections that follow, particularly section 5. My conclusion is that the defects in the exercise preclude using it to compare the two allocation methods with each other or with the scheduling committee method.

The simulation model is an extremely versatile tool and should not be abandoned in these ground-breaking difficulties. Another simulation exercise with airline participants (not necessarily the same ones) should be conducted, with some changes in the scenario (see section 5). Slot allocation should be simulated using (a) the scheduling committee, to establish a realistic baseline case, (b) common-price and discriminative-price auctions, and (c) a refined administrative allocation method. Each method should be simulated for several periods to allow schedules to reach an equilibrium and to minimize the chances of anomalous events appearing in the results. The time required for this additional study would be on the order of several weeks, and would therefore preclude attendance by airline participants in Washington. However, interaction between the participants and administrators could be accomplished via the same telephone line computer peripherals that afford the participants access to the simulation model.

## 1. PREFERRED ALLOCATION METHOD

The administrative allocation procedure exerted less pressure on the Blue team than the slot auction. This resulted from Blue having already developed a schedule during the period 2 auction which (a) met the slot quotas, and (b) produced Blue's largest pretax earnings during the exercise (before slot payments) - \$4.73 million. With this information in hand when the administrative allocation began, Blue felt that developing another slot-constrained schedule from the baseline schedule would be wasted effort in terms of the maximum-profit goal.

Blue's decision to implement its period 2 auction schedule in the administrative allocation simulation had a profound effect on the allocation process for all five airlines. For airport AAA, where Blue had used 83 slots in the baseline schedule, Blue requested only 61; this contraction by itself would have been enough to reduce the baseline (uncontrolled) movements in restricted hours from 213 to 191, below the daily quota of 195. Requests totaled only 176, or 19 less than the quota. Obviously the only challenge to meeting the slot quota at AAA was to arrange a few slides, and this was done quickly. The same comments apply to BBB, where the daily quota (180) exceeded requests (164) by 16 slots.

Airport CCC was more difficult to resolve because it was the only case where requests (167) were at the quota level (165). A fairly complex series of slides, coupled with a few outright reductions, was necessary to resolve CCC. These maneuvers were accomplished in short order by the teams in a scheduling committee-type meeting; yet the computerized assignment procedure might have continued indefinitely without any resolution.

As this discussion indicates, my preference for the administrative allocation method is qualified and is based upon circumstances in the exercise which would not parallel any real situation. In my opinion, although the exercise utilized a sophisticated simulation model capable of closely approximating reality, for various reasons (detailed in sections 4 and 5) the results of the exercise are not an adequate basis for selecting one allocation method over the other, or over the scheduling committee method.

## 2. MARKETING APPROACH UNDER SLOT CONSTRAINTS

The Blue team approach to market entry/exit and schedule adjustments on Blue's existing system was oriented toward maximizing profits under both methods of slot allocation, as well as in the initial simulation period when no slot constraints were imposed. Blue felt no need to pursue other goals as a result of either slot allocation method, and in fact would not have had the time to do so in any case (see section 4).

### 3. FAIRNESS OF ALLOCATION METHODS

The fairness of any slot allocation scheme to a given airline will depend on the particular viewpoint of that airline. Imposing a slot auction at a given airport might be less fair to an established carrier with extensive operations and connecting complexes at that airport, than it would be to a new carrier whose schedules are more flexible and can, if slot payments are too burdensome, shift its operations elsewhere. Conversely, imposing the administrative allocation on carriers with similar situations at the same airport might favor the larger carrier, which would get many slots based on its extensive pattern of service and large volume of connecting enplanements/deplanements, while the entrant would get just four slots. This is an important question, but it cannot be answered without some agreement as to what constitutes a fair slot allocation method. Such an agreement should balance the interests of passengers, shippers, airport authorities, local governments, air carriers, and other affected parties; given the broad constituencies involved, Congress might be an appropriate forum for this debate.

### 4. TIME CONSTRAINTS IN THE EXERCISE

In my opinion, there was not enough time to analyze the available information and develop plans of action based on it during any phase of the exercise. The Blue team neglected to reschedule many flights which our printouts identified as relatively unprofitable simply because time ran out. Likewise, we could have developed a more sophisticated bidding strategy had time allowed, particularly in the period 2 auction after we had the benefit of some bidding experience. I doubt that we would have acted differently given more time to prepare plans in the administrative allocation, since our plans simply represented various slides from a schedule we knew would be profitable (see section 1), and slides were the only changes we made to achieve resolution. However, had the quotas actually been such a serious constraint on operations in the administrative allocation that major rescheduling was required, we would have needed much more time. Lack of time to respond to all available information was one factor limiting the realism of the exercise (see section 5).

### 5. REALISM OF THE EXERCISE

This exercise was a pioneering effort in its use of computer simulation techniques to explore the effects of alternative policies on the national air transportation system; it proved that such simulations can serve as a tool in policy assessment. As might be expected in such a first-time endeavor, several features of the simulation scenario prevented the exercise from effectively approximating reality. Most serious was the quick transition from a route-regulated system having no slot constraints (the "initial state" at the beginning of the exercise) to a completely deregulated route environment with slot controls at the three busiest airports and an auction allocation system. <sup>1/</sup>

<sup>1/</sup> The "initial state" of the system given to the participants in the FAA exercise was created in December, 1979, at MIT by faculty and students at the Flight Transportation Laboratory (FTL). According to Dennis Mathäisel of FTL, the airline route structures created at MIT reflected the dictates of a central authority requiring the smaller lines to serve the smaller cities and limiting competition in large markets.

## 5. REALISM OF THE EXERCISE (continued)

Only one rescheduling attempt was allowed the teams between these two states, corresponding to a six-month period. The results of this rescheduling (the "base state" in the FAA description) certainly did not represent an equilibrium state under route deregulation, nor did this state reflect any airport congestion problems, slot constraints, or other access problems. In reality, of course, slot controls have existed for more than a decade and domestic route deregulation has been proceeding apace for the past 18 months. In order to simulate the process of route deregulation under slot constraints, the exercise should have allowed for several rounds of scheduling, with slot allocation by scheduling committee, before alternative slot allocation methods were evaluated.

Another major oversight in the simulation was the lack of alternative airports at the slot-controlled cities. In reality, the three cities with slot-controlled airports can be accessed through other airports which are not slot-controlled (Chicago-Midway; New York-Newark; Washington-Dulles/BWI). The simulated network should have included such airports.

Lesser defects of the simulation were the omission of pricing freedom and the absence of transitional market entry/exit costs. In reality, airlines incur large costs to shift resources (personnel, facilities, ground equipment, advertising, etc.) from their existing system to new markets; in the model no such costs were assessed. For example, in the first scheduling attempt airline White (the smallest of the five airlines, flying only DC-9's) was able to raise its after-tax profits from \$320,179 to \$4,018,298 by entering thirteen markets, dropping three, and increasing daily nonstop flights from 35 to 50. One of the markets entered by White was the 1938-mile AAA-XXX market, where White competed with three other airlines flying 727's and 707's. In reality, such an ambitious expansion program by such a small carrier would not generate a 1,255 percent increase in net income in the first six months, as White did in the exercise.

To generate valid predictions of the impact of various slot allocation methods on a deregulated air transportation system, the scenario should have allowed complete, or at least some, pricing freedom. In fact, it allowed none. The teams were not able to set fares so as to exploit the differences in their segment costs dictated by differing aircraft types and network characteristics. This omission is particularly serious when considering the results of the slot auction simulations, when carriers with pricing freedom would have had the option of either increasing fares in markets involving the slot-controlled airports or, by not raising fares, cross-subsidizing the slot payments with profits from other routes.

Other problems with extrapolating the results of the slot auction simulation to a real slot auction arise when one considers that no real slot auction has yet been conducted or even proposed in detail.



In the Polinomics study, an auction is described in which carriers proposing to serve small communities from a slot-controlled airport would participate in a separate auction process, bidding among themselves for slots reserved exclusively to them. <sup>2/</sup> Congress' historical concern for and sensitivity to small community service suggest that some such mechanism could be part of a real slot auction procedure. Since no special treatment for small communities was incorporated in the simulation scenario (in fact, service disappeared completely from two small cities in the network), the results have no bearing on an auction process which does allow for such preferred treatment. Obviously, if some slots were removed from the general auction at a given level of demand, slot prices would go up.

Perhaps the most critical feature of a real slot auction system would be the distribution of slot revenues. Logically, the money should be used to expand capacity at the congested airport, allowing higher quotas, lower slot payments, and lower costs to the airlines. This effect could be noticeable within the six-month simulation period for some airports, and the results of a simulation including this feature would be valuable. If, on the other hand, one assumes there will be no relief from quotas associated with slot payments, the simulation scenario should allow for fare differentials (as suggested above) which would discourage traffic using the slot-controlled airports. In either case, more than two simulation periods under the auction allocation system would be needed to fully explore its effects.

As noted above (see section 1) the administrative allocation procedure, as simulated, acted to assign requests for 507 slots at the three controlled airports when 540 were available. Realism requires that the number of desired slots be higher than the quota by five to ten percent or more, as is now the case at Washington National Airport.

In addition, a realistic simulation of administrative allocation would include some new entrants and carriers providing essential air service to reduce the slots available to established carriers. As is the case for auction allocation, several simulation periods would be necessary to explore the major effects of administrative allocation on the air transportation system.

<sup>2/</sup> D. Grether, M. Isaac, C. Plott, Alternative Methods of Allocating Airport Slots, section VI, at 12-14 (prepared by Polinomics Research Laboratories, Inc. for U.S. Civil Aeronautics Board, August, 1979).

In summary, the task of applying the MIT simulation tool to analyze the effects of alternative slot allocation methods is neither a success nor a failure; it is simply not finished. Simulation iterations, incorporating the variations mentioned herein must be undertaken before conclusions can be drawn from the exercise and applied to reality. To avoid the logistical problems and expense involved with convening a subsequent longer session in Washington, the participants could access a central computer by telephone lines from their home offices; they could then assimilate the exercise into their other activities. This would require more time for coordination in each phase of the exercise due to the geographical separation of the participants and administrators, but in my opinion this additional time would allow more thoughtful decisions by the participants and, therefore, a more realistic simulation (see section 4).

## 6. SUGGESTIONS FOR CHANGING THE ALLOCATION METHODS

The auction allocation method as it was simulated seems entirely practical. The question is whether the results it produces are the results that would be desired of a real auction allocation method. As noted in section 3, no definition of desirable results exists. A number of features that might be incorporated into an auction, but were not part of the exercise, are discussed above in section 5. Other possibilities include allowing retraction of bids, with the slots released to be sold on the aftermarket, and accepting successful bids at the bid price (discriminative price auction) rather than at the "common price". All of these variations should be studied further with definite performance criteria (in terms of passenger/shipper service, prices to consumers, costs to airlines, ease of entry, small community service, etc.) in mind.

The administrative allocation method, on the other hand, must be refined before it can be implemented. The exercise revealed that the computerized matching of plans (the assignment phase) may never result in a combination that satisfies the hourly quota. Once the daily allocations for each carrier are determined, the most effective procedure would be to convene a scheduling committee to arrange slides so that the hourly quota is met. If no face-to-face contact between carriers is permitted, then FAA will have to engage in a tedious process of soliciting plans, finding problem hours, and soliciting more plans to reduce operations in the problem hours, unless a better idea surfaces. Again, variations in the administrative allocation method should be studied in additional iterations of the simulation exercise, with performance measured against definite criteria.

## ERRATA

The FAA description of the exercise contains some factual errors which should be corrected before the description is translated into a final report.

Page 1 - W. Jeffrey Rowe attended the exercise for Delta and participated on the Blue Team, not Ted Maples.

Page 18 - The figures presented in Table 3.4 as net earnings before taxes or slot payments for the period 2 slot auction simulation are actually net earnings before taxes for the administrative allocation.

Page 21 - The operating statistics presented in Table 3.7C for the period 2 slot auction actually correspond to the administrative allocation.

EASTERN AIR LINES INCORPORATED / INTERNATIONAL AIRPORT / MIAMI, FLORIDA 33148 / 305-873-2211



March 24, 1980

Mr. John M. Rodgers  
Acting Chief, Economic Analysis Branch  
Department of Transportation  
Federal Aviation Administration  
Washington, D. C. 20591

Dear John:

Attached are my comments on the Draft Evaluation of the slot allocation test conducted during the week of February 11.

It is my understanding that the test focused on three main issues:

1. The practicality of two alternatives to the Schedule Committee process for slot allocation.
2. The impact of those alternatives on carriers' financial performance.
3. The impact on service to individual communities.

I believe the test uncovered specific implementation problems associated with each of the two methods. These are detailed in the attached. However, the results do not permit a valid evaluation of the impact of either method on carrier profitability or service levels by city-pair.

Since the participants were unfamiliar at the outset with their own networks and with the decision rules built into the MIT model, you would expect financial performance to improve with each iteration. That reflects both the learning process and a trend towards competitive equilibrium.

Mr. John M. Rogers

March 24, 1980

Therefore, the fact that profits did not deteriorate under the slot allocation methods tested does not suggest the absence of a significant economic penalty. Instead, I would conclude that the learning curve effect offset the cost of slot allocations.

Moreover, because of the limited time available to properly analyze the data and schedule alternatives, resource allocation decisions did not necessarily reflect the economics of service in specific city-pairs. In fact, a post-test review of the data suggests significant changes to service patterns. This is discussed further in the attached.

Therefore, I would urge that any definitive conclusions be limited in scope to the implementation issues. Clearly, additional work has to be done to determine the effect of the slot allocation alternatives on carrier financial performance and on service patterns.

Sincerely,



W. H. Pacelli  
Specialist  
Planning

Attachment

SLOT ALLOCATION EVALUATION TEST

## Response to Questions on Page 41 of Draft Report

1. The two methods are based on different criteria. The Trading Post Auction gives priority to profit/revenue per flight and therefore longer haul flights. The Administrative method is based on passengers carried and airports served regardless of length of haul. In effect, that is a policy question, which I cannot address in these comments. Instead, I will focus on the practical implementation issues.

The test suggested serious problems with the Trading Post Auction in achieving the hour-by-hour adjustments needed to fully utilize the slots available. Indicative of this problem are slot prices of over \$700 in one hour while some slots in an adjacent hour were unused.

In addition, slot prices tended to be above those which one might expect based on economic theory. The upward pressure on slots was caused by (1) a basic tendency to protect existing operations, regardless of cost, (2) the uncertainty of slots in any given hour, resulting in bids for unneeded slots in adjacent hours, and (3) uncertainty about the real value of a slot, both to the individual airline and to competitors.

The Administrative allocation approach did provide more stability and generally was easier to work with. However, its utility was limited in the hour-by-hour assignment in that so many submissions of differing plans were necessary for a "computer solution." This would suggest some type of schedule committee to finalize hour-by-hour assignments.

2. We did not alter our marketing approach, but, had we had time to more fully evaluate the effect of slot reductions and price, we undoubtedly would have.

Had financial information been presented by segment and operating profit show rather than contribution, the resulting aircraft deployment would have been much different. For example, the revenue generated in the A-C market could have supported more flights than the B-C market. Yet, after Auction 1, there were 42 A-C flights vs 51 B-C flights. (See Exhibit A).

There was insufficient time to examine the effect of slot payment on flight profitability, particularly on the double slotted segments. It was discovered after the test that slot costs on short-haul flights between slotted airports so drastically lowered the profit that redeployment of these flights would have been necessary.

3. The term fair is very subjective and depends on the criteria used.
4. More time was needed to make schedule changes necessitated by not receiving desired slots and the price of a slot, especially in the Trading Post method.

Time allowed for the bidding process was totally inadequate. The amount of data that is generated and must be analyzed in order to make intelligent bids is very large. Only after inordinately high price levels (4.8% of total revenue) were reached in Auction 1 did some carriers drop out of the bidding. While, it is true that things settled down in Auction 2, it must be remembered that in the test certain pressures were absent. These pressures are new aircraft deliveries and market aggressiveness.

5. No. Several iterations should have been made prior to testing the slot allocation methods to give the teams a familiarity with the game and the route network. The "noise level" of the Blue team's losses and massive swings in load factor and utilization from period to period render analysis of the economic data highly suspect. It is obvious from tables presented in the Draft Report that Blue had trouble finding a niche in this exercise and impacted the entire industry. Other participants, to a less obvious extent, also were going through a learning process. It is doubtful, therefore, that any concrete conclusions can be drawn about the financial impact on the industry.

#### 6. Trading Post Auction

This alternative needs a mechanism that relieves the upward pressure on the price of slots and facilitates the process of moving to adjacent hours. We are not sure what that should be, but believe the system is ineffective without it.

#### Administrative Allocation

The criteria used to allocate slots, we believe, should include through passengers because they are using the airport runway capacity every bit as much as connecting passengers. This alternative would function better as a slot assignment tool if flexibility could be allowed in the maximum per hour quota by carrier. Having a maximum per hour seemed to work against an airport solution rather than assist in reaching one. Also, once the slot allocations by carrier are determined, an interactive process between carriers (similar to the schedule committee) should be permitted to reach an airport resolution.

Exhibit A

	<u>A-C</u>	<u>B-C</u>
Passengers (Both Directions) <u>1/</u>	4,514.1	3,358.5
X Net Fare <u>2/</u>	\$ 51.66	\$ 18.88
	<hr/>	<hr/>
Net Revenue	\$233,198.40	\$63,408.48
+Average O-W Direct		
Cost of 727	2,946.11	1,047.89
	<hr/>	<hr/>
Maximum number of trips that could be economically operated	79	61

1/ Base state

2/ Published fare less 15% for general and administrative  
expenses and less \$14.00 for passenger handling cost.





PIEDMONT AIRLINES  
SMITH REYNOLDS AIRPORT  
WINSTON-SALEM N.C. 27102

March 20, 1980

Mr. John M. Rodgers  
Acting Chief, Economic Analysis Branch  
Department of Transportation  
Federal Aviation Administration  
Washington, D. C. 20591

Dear Mr. Rodgers:

The week we spent in Washington reviewing the two slot allocation methods was enjoyable as well as educational. Our only regret was that more time was not allocated to the Administrative Method, which in our view, could offer a feasible solution to a very complex problem.

Aside from the cost, we believe the trading post auction to be too cumbersome to administer. It would require a team of airline personnel with the technological know-how in scheduling, computers, and finance. In addition, schedule stability would be much in doubt. This method would also favor the larger carriers with the longer hauls in that they would be in better shape financially to afford slots.

Although the administrative method attained little success during the testing period in Washington, it does appear to have a number of points worthy of consideration. Some of these are:

1. Carriers current slot allocation considered.
2. Number of passengers enplaned/deplaned (except for exempted flights serving essential air service points, flights would have to maintain good load factors to remain).
3. Number of cities served on a nonstop basis considered.
4. Restraint on new carriers entering a slot controlled airport.

It would appear a combination of the Administrative System and Schedule Committee could be an alternative to any method submitted thus far. With a firm approach toward total numbers, administered by the FAA, the Schedule Committee could in most instances, attain resolution by sliding thru out the day.

The following are some thoughts on the actual exercise.

Problem 1:

On Page 13 of the slot allocation evaluation, the indication is that there may be an efficiency involved with the auction system because of the comparison of profitability during the various iteration. Such a comparison, in our opinion, is not valid. Since each of the teams were given their base schedules, and except for a few minor changes, these schedules formed a base period. Any comparison to it fails to recognize efficiencies through the scheduling changes made by "scheduling experts" in the latter iteration. The slot allocation evaluation makes mention of this very fact in the last sentence on Page 16.

Problem 2:

The MIT model is an excellent model but does not compare to the real world scheduling practices. For example:

- (a) Inter-line connections were not considered.
- (b) The "schedulers" did not have a good feel of their cost levels.
- (c) There was no traffic advantage of market identity.
- (d) There was no cost penalty that we could determine for significantly reducing operations at one station or increasing it at another, i.e., at the extreme, a carrier could drop a city and enter another city with no cost penalty.
- (e) The model contained three types of airplanes including the DC-9, 727 and a 707. It is hard to determine, but we do not believe an aircraft preference factor was used and if there was one, it did not seem to be comparable to real world experience.
- (f) One of the greatest advantages in a slot auction system would be the use of wide-bodies equipment because of its efficiency in terms of cost, the public appeal of such aircraft and the greater number of passengers carried by this equipment in relation to narrow-bodied airplanes. This makes us wonder why such an aircraft was not used in the MIT model.
- (g) The larger airlines are much more sophisticated and better equipped to handle their massive systems in the real world. The MIT model does not reflect this inherent advantage.

Problem 3:

The model was set-up to maximize short term profit. Doing such, it overlooks real world realities. In our opinion, bigger carriers would be willing to sacrifice short term profit in order to become more dominant factors in the market in the long term. They would be in a better position to force small carriers out of markets and suffer short term losses in order to reap better long term profits.

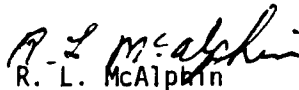
Mr. John M. Rodgers  
Page 3  
March 20, 1980

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We would not advocate another meeting in the same posture as before. Cost of MIT Personnel, computer equipment, hotel rooms, etc., would be unreasonable for what we would expect to accomplish. We would suggest further refinement of the administrative system and a later review or evaluation exercise.

Sincerely,

PIEDMONT AIRLINES



R. L. McAlpin  
Staff Assistant Vice President -  
Airline Scheduling



R. L. James  
Director - Route Development

RLM/lr

**TWA**

605 THIRD AVENUE, NEW YORK, NEW YORK, U.S.A. 10016

65

March 25, 1980

John M. Rodgers  
Acting Chief, Economic Analysis Branch  
Department of Transportation  
Federal Aviation Administration  
Washington, D.C. 20591

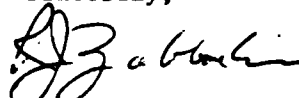
Dear Mr. Rodgers:

Enclosed are comments pertaining to the FAA slot allocation exercise as you requested.

It is the desire of Trans World Airlines to see the slot allocation problem resolved to the mutual satisfaction of all interested parties. In light of this, TWA fully backs the position the ATA has taken to preserve the current system for slot allocations until a new system is developed that will fully satisfy the needs of the industry.

The enclosed comments are in no way to be taken as an endorsement of either one or both of the methods under study, but hopefully, will assist in the search for a solution to this very serious problem.

Sincerely,

  
Richard J. Zablocki

Enc.

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**TRANS WORLD AIRLINES, INC.**

- I. Which method did you prefer - the Trading Post Auction or the Administrative Allocation? Why?

The Administrative Allocation procedure, although flawed, seems to be the better method. The main objection to the Trading Post Auction was the considerable expense required to obtain the desired slots. This added expense obviously has to be passed on to the consumer either in the form of peak hour surcharges or across the board fare increases. This does not serve the best interests of the airline or the travelling public. With the Administrative procedure it was possible to acquire all of the desired slots that Airline White needed without incurring any additional costs. Unfortunately, the flaw in this method showed up in the hourly distribution of these slots. It is not realistic to expect to schedule an airline using an even distribution of operations throughout the day. Natural peaks will occur due to length of haul and connection bank timing, in addition to passenger preference.

- II. In each of the two methods did you significantly alter your airline marketing approach as a result of the slot allocation? If so, in what way?

The Trading Post Auction allowed Airline White to maintain its schedule intact simply by using a method of progressively inflated bidding for the desired slots. Since the number of peak hour slots that were desired by Airline White were minimal it was fairly safe to assume that a high bid would be less damaging for this Company than any of its competitors due to the overall number of bids tendered. Those airlines desiring more slots in the peak hours would or should be more conservative in their bidding to insure a minimum expense.

The Administrative Procedure actually worked differently for airport AAA than at airports BBB and CCC. The allocations at airport AAA seemed to be handled strictly by the rules of the game and in so doing created a situation for Airline White that was less than desirable. In offering alternative plans to reach an overall solution, Airline White found this situation coming to a resolution using its least desirable plan. This, in conjunction with the limits placed on the maximum number of slots an airline could request in an hour, in my opinion, was a serious blow to this airline's profitability.

At airports BBB and CCC the rules were somewhat more relaxed when a solution by the original procedures could not be reached. Through the committee method, Airline White was not only able to assist in reaching a solution by rescheduling, but did so in such a way as to improve its profit making potential. Slot allocation by means of a scheduling committee was a definite plus for Airline White.

- III. Do you consider the two methods to be fair? If not, in what way are they unfair?

The Trading Post method seems to favor the smaller airline that is not heavily scheduled at the slot restricted airports. As long as the airline was willing to pay the price, the slot was relatively easy to acquire. Although we did not fully see it during this demonstration, a serious escalation in the bids seems destined to take place every time the participants sense a particular round of bids may be final.

The small airline can afford to pay the high price and spread the cost out over its entire route structure, which for the most part is operating at unrestricted airports. The larger trunk carriers that are heavily concentrated at the restricted airports will have to either pay the high prices and pass these increased costs on to the consumer or reduce its operations.

The Administrative method, as an alternative, tended to be too restrictive. It is my opinion that an administrative procedure set up with the original guidelines will most likely enable the large, strong airlines to retain their strength and grow while creating a downward spiral for the smaller, weaker competitors. With each successive allocation period as the smaller airlines' share of traffic shrinks due to a reduced number of operations, their total number of slots allocated will decrease. Thus, less operations are allowed, less destinations are served and, of course, fewer enplanements and deplanements will be accounted for. The following period's allocation of slots will be still smaller to these airlines based on the previous results.

- IV. Were you able to handle the total information flow comfortably in the time available in each method? Was more time required (a) for re-scheduling, (b) for bidding, and/or (c) for submitting preference plans in the Administrative method?

As the representative for Airline White, the smallest yet one of the most profitable airlines, I had sufficient time to handle all aspects of the agenda. After the initial period of scheduling, the relative strength that was developed due to the overall profitability allowed me to have a lot of control over the various situations in terms of my own schedule.

- V. Was the evaluation exercise sufficiently realistic to allow conclusions to be drawn from the real world? If not, how would you make it more realistic?

The only major problem in terms of this exercise being realistic was the aspect whereby the airlines were able to change their schedules

with relative ease. There are many constraints that a scheduler must face in the process of developing a schedule, slots being only a minor issue. But, once a schedule has been developed, even a small 5 minute change has the potential to create problems at various other points on the route structure. Certainly, additions and deletions of service and likewise, major time changes can create a catastrophic chain reaction.

I raise this point to indicate the great deal of difficulty a scheduler could have when trying to come up with alternative plans for the Administrative method or trying to maneuver an operation so as to avoid a high cost slot in the Trading Post method. In the real world I think you will find that the airlines are not able to be as cooperative or be able to restore the same profit potential to a flight or series of flights that must go through forced schedule moves.

- VI. Assuming one had to implement one of the two alternative allocation methods, what changes would you recommend in each method to make it more practical?

Some changes that I think are worth experimenting with for the Trading Post Auction would be to eliminate bidding with money and instead devise a point system. Points would be allocated to each airline based on variables such as airline size, history, traffic and efficiency similar to the Administrative method. The airlines would then be free to bid on whatever slots they desire using these points. A post trading period would be desirable where the airlines would be allowed to swap slots on a one for one basis. This would allow the airlines that were not able to acquire their desired slots to try to make the best situation they can out of it.

The Administrative method might best be improved by simply limiting its use to the overall allocation of slots to the individual airlines. In conjunction with this, a scheduling committee type of operation could then take over and go through the current processes in use for deciding the hourly allocations. This would satisfy the needs of the new entrants and yet preserve the flexibility of the scheduling committees.

WASHINGTON NATIONAL AIRPORT • WASHINGTON, D.C. 20001

March 31, 1980

John M. Rodgers  
Acting Chief of the  
Economic Analysis Branch  
Department of Transportation  
Federal Aviation Administration  
800 Independence Avenue  
Washington, D.C. 20591

Dear Mr. Rodgers:

This is in reply to your letter of March 7, 1980 with which you forwarded the results of the management game. First let me apologize for the delay in responding but as I already mentioned to you I did not receive this report until March 17, 1980 and with the press of closing out our summer schedule plus digesting the information contained in this report, it was not possible to respond earlier.

Per your request the following are my thoughts and observations concerning this subject:

For reasons which will be discussed below, I do not feel that I can support either the trading post auction or the administrative allocation.

The base schedule on which the entire management game was predicated was developed in the short period of one afternoon. In the early stages I can say that I was not sufficiently familiar with either my own airline (Gold Airlines) or with the market place in which this airline would operate to provide profitability comparisons between periods of time. I know in my case that during the various auction periods I made improvements to my own airline as my familiarity increased with the markets available and the schedules of other carriers. While I certainly cannot speak for the other airlines, I am convinced that this was true of each participant. As a result, it is my impression that the base period was grossly understated in terms of industry profitability and the comparison of profitability results with later option periods was distorted. The implied result on page 13 that slot purchasing did not interfere with airline



profits (and costs to travelers) is not a logical conclusion. Again, it was the action of the schedulers becoming more familiar with industry traffic, the competition, their aircraft and the model manipulations that allowed the results to occur as they did.

Further to the model itself, I do not believe that there was sufficient realism to determine if the results could be applied to the real world airline operation. On the operational side, there were no constraints or costs considered for maintenance, airport facilities, ground servicing, crew restraints or airport curfews. On the traffic side which is indicated on page 4 as the heart of the game, it appears that the model contained unduly large amounts of traffic stimulation evidenced by the results generated by operating off-peak schedules. As an example Gold Airlines added a very late night short haul round-trip and generated a load factor of approximately 85% which did not appear realistic. I also found that in one particular market the break even level was only twelve passengers. This again demonstrates that the only reason the industry showed a profit increase after paying for slots is because the participants learned how to use the model's idiosyncrasies to their advantage. The equipment types used in this exercise did not offer sufficient disparity of capacity. In the real world, the price carriers are willing to pay for slots will be directly related to revenue potential and carriers with large capacity aircraft could easily outbid those with smaller aircraft. The largest aircraft used in the model was a B-707 and the smallest a DC-9 while in reality equipment could vary from jet type aircraft of as little as 74 seats to the Boeing 747s with potential capacity of 400 seats or greater.

Based on my participation, it is my impression that neither method is totally fair. Under the auction method the cost of obtaining the necessary slots would result in either increased operating costs or higher fares to the traveling public. These added costs could result in discouraging competition in cases where a new segment under consideration has one or both airports under slot allocation. Further, carriers themselves could speculate in slots by purchasing unnecessary slots and then attempting to sell them at a profit in the after market. In the exercise Gold Airlines did this with some degree of success. Carriers could even purchase slots in excess of their needs to stifle competition.

Under the administrative allocation system provision is made for new carriers to automatically receive four slots. However, incumbent carriers could find it much more difficult or perhaps impossible to either enter new markets or expand existing ones.

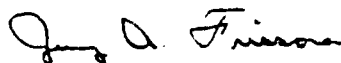
U.S. Air  
March 31, 1980  
Page Three

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Under this system they have no way of being reasonably certain of obtaining the slots necessary for such service. Infact, under this system I believe it possible for incumbent carriers to have to involuntarily reduce existing services to the public to accommodate a new carrier's slot request. This I believe would severely restrict the free market place.

Based on the above, I believe that a great deal of additional study is required on both plans before a final determination can be made as to the viability of either option. Considering the limited experience the industry has had with these two options, I believe that as currently constituted both fall far short of the intended goal of providing a vehicle which satisfies the interests of both the public and the airline industry. However, if either plan were mandated by the government I presume the industry would have a way of making it work, yet this study fails to identify many of the ramifications for the traveling public and the industry.

Very truly yours,



Jerry A. Frissora

JAF/kml

## 6. CONCLUSION

The testing of two slot allocation methods in the environment of the Airline Management Game has been demonstrated. In particular the Slot Exchange Auction has been subjected to a gaming/simulation test in conjunction with fairly realistic airline scheduling. The test was inconclusive in regard to (a) convergence to equilibrium, (b) the economic efficiency and equitability of the Slot Exchange method. Further testing should be undertaken before implementation can be seriously advocated. These further tests should provide for more time for bidding; more rounds of bidding; possible application of one or another stopping rule; improved realism in the game scenario; and, finally, an experimental design with controls for participant learning. Under these conditions the advantages and disadvantages of the Slot Exchange can be fully discovered in the testing environment so as to avoid faulty implementation or adoption of an inferior allocation method.

## REFERENCES

1. Antonio Elias, The Development of an Operational Game for the U.S. Domestic Airline Industry, Flight Transportation Laboratory, Massachusetts Institute of Technology, Cambridge, MA, FTL Report R78-5, February 1979.
2. Federal Aviation Administration, Slot Allocation Evaluation, March 1980.

APPENDIX A  
GENERAL APPENDIX

Table A-1	Aircraft Data
Table A-2	Network Data
Table A-3	Airport Data
Table A-4	Initial Schedules
Table A-5	Traffic Data
Table A-6	Period 1 Schedules
Table A-7	Period 2 Schedules
Table A-8	Period 1 Traffic Data
Table A-9	Period 2 Traffic Data

## TABLE 3.1 AIRCRAFT DATA

MIT-FTA CASS FILE ID:FAA\_0001 UNIVERSE FILE PRINTOUT LAST MODIFIED 80/01/18 14:16:37.00

TYPE	SEATS	RANGE (M)	SPEED (MPH)	DOC/M		DOC/D		DOC/S-M		TF/DP MIN	TF/DAY HH:MM
				\$	\$	\$	\$				
DC9	90	2000	480	893	103	703	0.02067	7	0:47		
727	130	2000	480	1159	140	1280	0.01857	7	1:06		
707	150	4000	480	1671	230	1216	0.02321	8	0:43		

#### EXPLANATION OF TERMS:

DOC/M is the direct operating costs per aircraft block hour. It includes all the costs that can be allocated to flight time, e.g. fuel, crew, direct maintenance, etc.

DOC/D is the direct operating costs per aircraft takeoff/landing cycle. It includes all the costs that can be allocated to a takeoff/landing cycle, such as dispatching, ground servicing, tire wear, etc. It does not include landing fees or slot charges.

DOC/D is the indirect operating costs that are independent of the flight time, such as maintenance burden, insurance, etc. It does not include depreciation or financial or lease costs.

The above three items are the components of the operating costs. The following three items are derived from the above costs, and are presented for reference only:

DOC/S-M the derived direct operating costs per seat-mile.

TF/DP The number of flight minutes that would cost the same as a landing/takeoff cycle.

TF/DAY the number of flight minutes that would cost the same as the daily indirect costs.

## TABLE 3-2 NETWORK DATA



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\*\*\*\*\* AIRPORT DISTANCES AND BLOCK TIMES \*\*\*\*\*

BITPTA CASE - FILE ID:PAI\_0001

FR TO	NM	DCS	707	727
AAA BDB	517	1:30	1:30	1:30
AAA CCC	539	1:33	1:33	1:33
AAA DDD	508	1:35	1:35	1:35
AAA EEE	147	0:38	0:38	0:38
AAA FFF	151	0:38	0:38	0:38
AAA GGG	482	1:20	1:20	1:20
AAA HHH	755	1:54	1:54	1:54
AAA III	269	1:08	1:08	1:08
AAA JJJ	959	1:26	1:26	1:26
AAA KKK	461	1:14	1:14	1:14
AAA LLL	330	0:58	0:58	0:58
AAA MMM	149	0:35	0:35	0:35
AAA NNN	179	0:39	0:39	0:39
AAA OOO	300	0:54	0:54	0:54
AAA PPP	182	0:39	0:39	0:39
AAA RRR	1684	3:54	3:54	3:54
BBB AAA	517	1:30	1:30	1:30
BBB CCC	153	0:47	0:47	0:47
BBB DDD	353	1:08	1:08	1:08
BBB EEE	455	1:18	1:18	1:18
BBB FFF	553	1:31	1:31	1:31
BBB GGG	434	1:16	1:16	1:16
BBB HHH	259	0:54	0:54	0:54
BBB III	244	0:54	0:54	0:54
BBB JJJ	233	0:48	0:48	0:48
BBB KKK	422	1:11	1:11	1:11
BBB LLL	167	0:42	0:42	0:42
BBB MMM	530	1:25	1:25	1:25
BBB NNN	695	1:45	1:45	1:45
BBB OOO	436	1:13	1:13	1:13
BBB PPP	337	1:01	1:01	1:01
BBB RRR	2078	4:45	4:45	4:45
CCC AAA	539	1:33	1:33	1:33
CCC BBB	153	0:47	0:47	0:47
CCC DDD	202	0:49	0:49	0:49
CCC EEE	438	1:16	1:16	1:16
CCC FFF	612	1:38	1:38	1:38
CCC GGG	572	1:33	1:33	1:33
CCC HHH	360	1:07	1:07	1:07
CCC III	184	0:47	0:47	0:47
CCC JJJ	386	1:07	1:07	1:07
CCC KKK	303	0:56	0:56	0:56
CCC LLL	236	0:48	0:48	0:48
CCC MMM	508	1:22	1:22	1:22
CCC NNN	704	1:47	1:47	1:47
CCC OOO	540	1:26	1:26	1:26
CCC PPP	380	1:06	1:06	1:06
CCC RRR	2172	4:57	4:57	4:57
DDD AAA	508	1:35	1:35	1:35
DDD BBB	353	1:08	1:08	1:08
DDD CCC	202	0:49	0:49	0:49
DDD EEE	453	1:14	1:14	1:14
DDD FFF	690	1:45	1:45	1:45
DDD GGG	747	1:51	1:51	1:51
DDD HHH	540	1:26	1:26	1:26
DDD III	235	0:49	0:49	0:49

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\*\*\*\* AIRPORT DISTANCES AND BLOCK TIMES \*\*\*\*

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PR	TO	MR	DCB	707	727
000	JJJ	595	1:20	1:28	1:28
000	AAA	178	0:37	0:37	0:37
000	LLL	370	1:01	1:01	1:01
000	MMM	504	1:10	1:10	1:10
000	NNN	722	1:45	1:45	1:45
000	OOO	678	1:30	1:30	1:30
000	PPP	474	1:14	1:14	1:14
000	RRR	2267	5:05	5:05	5:05
000	AAA	147	0:30	0:30	0:30
000	BBB	455	1:10	1:10	1:10
000	CCC	430	1:10	1:10	1:10
000	DDD	453	1:14	1:14	1:14
000	EEE	790	0:52	0:52	0:52
000	FFF	540	1:24	1:24	1:24
000	GGG	711	1:44	1:44	1:44
000	HHH	256	0:50	0:50	0:50
000	III	558	1:22	1:22	1:22
000	JJJ	315	0:52	0:52	0:52
000	KKK	278	0:47	0:47	0:47
000	LLL	74	0:22	0:22	0:22
000	MMM	272	0:47	0:47	0:47
000	NNN	386	1:01	1:01	1:01
000	OOO	179	0:35	0:35	0:35
000	PPP	1829	4:08	4:08	4:08
000	RRR	151	0:30	0:30	0:30
000	AAA	553	1:31	1:31	1:31
000	BBB	612	1:30	1:30	1:30
000	CCC	680	1:45	1:45	1:45
000	DDD	290	0:52	0:52	0:52
000	EEE	380	1:04	1:04	1:04
000	FFF	760	1:51	1:51	1:51
000	GGG	466	1:10	1:10	1:10
000	HHH	529	1:19	1:19	1:19
000	III	593	1:27	1:27	1:27
000	LLL	380	1:00	1:00	1:00
000	MMM	300	0:50	0:50	0:50
000	NNN	244	0:43	0:43	0:43
000	OOO	203	0:30	0:30	0:30
000	PPP	233	0:42	0:42	0:42
000	RRR	1569	3:36	3:36	3:36
000	AAA	462	1:20	1:20	1:20
000	BBB	434	1:16	1:16	1:16
000	CCC	572	1:33	1:33	1:33
000	DDD	747	1:51	1:51	1:51
000	EEE	540	1:24	1:24	1:24
000	FFF	380	1:04	1:04	1:04
000	GGG	509	1:10	1:10	1:10
000	HHH	538	1:25	1:25	1:25
000	III	251	0:44	0:44	0:44
000	JJJ	734	1:44	1:44	1:44
000	KKK	306	1:01	1:01	1:01
000	LLL	601	1:20	1:20	1:20
000	MMM	628	1:31	1:31	1:31
000	NNN	186	0:36	0:36	0:36
000	OOO	372	0:50	0:50	0:50
000	PPP	1890	3:51	3:51	3:51

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\*\*\*\* AIRPORT DISTANCES AND BLOCK TIMES \*\*\*\*

METPTA CASS - FILE 18:FAA-0001

PR TO	MM	DC9	707	727
MM AAA	755	1:54	1:54	1:54
MM BBB	259	0:54	0:54	0:54
MM CCC	360	1:07	1:07	1:07
MM DDD	540	1:26	1:26	1:26
MM EEE	711	1:44	1:44	1:44
MM FFF	760	1:51	1:51	1:51
MM GGG	500	1:18	1:19	1:19
MM HHH	501	1:20	1:20	1:20
MM IJJ	260	0:45	0:45	0:45
MM KKK	661	1:35	1:35	1:35
MM LLL	435	1:07	1:07	1:07
MM MMM	785	1:51	1:51	1:51
MM NNN	935	2:09	2:09	2:09
MM ODD	597	1:27	1:27	1:27
MM PPP	573	1:24	1:24	1:24
MM RXX	2200	1:24	1:24	1:24
MM AAA	369	1:08	1:08	1:08
MM BBB	244	0:54	0:54	0:54
MM CCC	184	0:47	0:47	0:47
MM DDD	235	0:49	0:49	0:49
MM EEE	256	0:50	0:50	0:50
MM FFF	466	1:16	1:16	1:16
MM GGG	538	1:25	1:25	1:25
MM HHH	501	1:20	1:20	1:20
MM IJJ	430	1:08	1:08	1:08
MM KKK	201	0:40	0:40	0:40
MM LLL	151	0:33	0:33	0:33
MM MMM	324	0:55	0:55	0:55
MM NNN	525	1:20	1:20	1:20
MM ODD	447	1:10	1:10	1:10
MM PPP	239	0:44	0:44	0:44
MM RXX	2036	1:26	1:26	1:26
MM AAA	559	1:26	1:26	1:26
MM BBB	233	0:48	0:48	0:48
MM CCC	386	1:07	1:07	1:07
MM DDD	505	1:28	1:28	1:28
MM EEE	558	1:22	1:22	1:22
MM FFF	529	1:19	1:19	1:19
MM GGG	251	0:44	0:44	0:44
MM HHH	260	0:45	0:45	0:45
MM IJJ	430	1:08	1:08	1:08
MM KKK	628	1:28	1:28	1:28
MM LLL	380	0:47	0:47	0:47
MM MMM	628	1:28	1:28	1:28
MM NNN	734	1:41	1:41	1:41
MM ODD	246	0:53	0:53	0:53
MM PPP	380	0:58	0:58	0:58
MM RXX	1941	4:19	4:19	4:19
MM AAA	481	1:14	1:14	1:14
MM BBB	422	1:11	1:11	1:11
MM CCC	303	0:56	0:56	0:56
MM DDD	179	0:37	0:37	0:37
MM EEE	315	0:52	0:52	0:52
MM FFF	593	1:27	1:27	1:27
MM GGG	734	1:44	1:44	1:44
MM HHH	661	1:35	1:35	1:35

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\*\*\*\*\* AIRPORT DISTANCES AND BLOCK TIMES \*\*\*\*\*

BITPTA CASS - FILE ID:FAA\_0001

PR TO	MM	DC9	707	727
MMR 111	201	0:40	0:40	0:40
MMR JJJ	628	1:28	1:28	1:28
MMR LLL	351	0:53	0:53	0:53
MMR MMM	350	0:53	0:53	0:53
MMR NNN	569	1:21	1:21	1:21
MMR OOO	624	1:28	1:28	1:28
MMR PPP	397	0:50	0:59	0:59
MMR RRR	2144		4:45	
LLL AAA	330	0:50	0:50	0:50
LLL BBB	187	0:42	0:42	0:42
LLL CCC	236	0:48	0:48	0:48
LLL DDD	370	1:01	1:01	1:01
LLL EEE	276	0:47	0:47	0:47
LLL FFF	300	1:00	1:00	1:00
LLL GGG	386	1:01	1:01	1:01
LLL HHH	435	1:07	1:07	1:07
LLL III	151	0:33	0:33	0:33
LLL JJJ	300	0:47	0:47	0:47
LLL KKK	351	0:53	0:53	0:53
LLL MMM	251	0:53	0:53	0:53
LLL NNN	508	1:13	1:13	1:13
LLL OOO	311	0:48	0:48	0:48
LLL PPP	153	0:29	0:29	0:29
LLL RRR	1935	4:18	4:18	4:18
MMR AAA	149	0:35	0:35	0:35
MMR BBB	530	1:25	1:25	1:25
MMR CCC	508	1:22	1:22	1:22
MMR DDD	584	1:18	1:18	1:18
MMR EEE	74	0:22	0:22	0:22
MMR FFF	300	0:50	0:50	0:50
MMR GGG	601	1:28	1:28	1:28
MMR HHH	785	1:51	1:51	1:51
MMR III	324	0:55	0:55	0:55
MMR JJJ	628	1:28	1:28	1:28
MMR KKK	350	0:53	0:53	0:53
MMR LLL	351	0:53	0:53	0:53
MMR MMM	219	0:37	0:37	0:37
MMR OOO	430	1:03	1:03	1:03
MMR PPP	244	0:48	0:48	0:48
MMR RRR	1799	4:01	4:01	4:01
MMR AAA	179	0:39	0:39	0:39
MMR BBB	695	1:45	1:45	1:45
MMR CCC	704	1:47	1:47	1:47
MMR DDD	122	1:45	1:45	1:45
MMR EEE	72	0:47	0:47	0:47
MMR FFF	244	0:43	0:43	0:43
MMR GGG	628	1:31	1:31	1:31
MMR HHH	935	2:09	2:09	2:09
MMR III	525	1:20	1:20	1:20
MMR JJJ	734	1:41	1:41	1:41
MMR KKK	569	1:21	1:21	1:21
MMR LLL	508	1:13	1:13	1:13
MMR MMM	219	0:37	0:37	0:37
MMR OOO	442	1:05	1:05	1:05
MMR PPP	262	0:55	0:55	0:55
MMR RRR	1589	3:35	3:35	3:35

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\*\*\* AIRPORT DISTANCES AND BLOCK TIMES \*\*\*

MUTPA CASS - FILE ID:FAA\_0001

FR TO	WM	DC9	707	727
000 AAA	300	0:54	0:54	0:54
000 BBB	426	1:13	1:13	1:13
000 CCC	540	1:26	1:26	1:26
000 DDD	679	1:39	1:39	1:39
000 EEE	808	1:51	1:51	1:51
000 FFF	923	2:03	2:03	2:03
000 GGG	106	0:36	0:36	0:36
000 HHH	597	1:27	1:27	1:27
000 III	447	1:10	1:10	1:10
000 JJJ	346	0:53	0:53	0:53
000 KKK	624	1:28	1:28	1:28
000 LLL	311	0:46	0:46	0:46
000 MMM	436	1:03	1:03	1:03
000 NNN	442	1:05	1:05	1:05
000 PPP	229	0:38	0:38	0:38
000 QQQ	1642	3:42	3:42	3:42
000 RRR	102	0:39	0:39	0:39
000 SSS	337	1:01	1:01	1:01
000 TTT	380	1:06	1:06	1:06
000 UUU	474	1:14	1:14	1:14
000 VVV	179	0:35	0:35	0:35
000 WWW	232	0:42	0:42	0:42
000 XXX	372	0:59	0:59	0:59
000 YYY	573	1:24	1:24	1:24
000 ZZZ	239	0:44	0:44	0:44
000 AAA	388	0:58	0:58	0:58
000 BBB	397	0:59	0:59	0:59
000 CCC	153	0:29	0:29	0:29
000 DDD	244	0:40	0:40	0:40
000 EEE	362	0:55	0:55	0:55
000 FFF	229	0:38	0:38	0:38
000 GGG	1800	4:02	4:02	4:02
000 HHH	1884	3:54	3:54	3:54
000 III	2078	4:45	4:45	4:45
000 JJJ	2172	4:57	4:57	4:57
000 KKK	2267	5:05	5:05	5:05
000 LLL	1829	4:08	4:08	4:08
000 MMM	1569	3:36	3:36	3:36
000 NNN	1690	3:51	3:51	3:51
000 OOO	2200	4:55	4:55	4:55
000 PPP	2036	4:36	4:36	4:36
000 QQQ	1941	4:19	4:19	4:19
000 RRR	2144	4:45	4:45	4:45
000 SSS	1935	4:18	4:18	4:18
000 TTT	1799	4:01	4:01	4:01
000 UUU	1549	3:35	3:35	3:35
000 VVV	1642	3:42	3:42	3:42
000 WWW	1800	4:02	4:02	4:02

LAST MODIF: 80/01/18 14:18:37.00

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C O S T P E R S T A G E

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BITPTA CASE - FILE 10:FAA-0001

PR TO	NR	DC9	707	727
AAA 000	517	1452	2754	1891
AAA CCC	539	1493	2830	1944
AAA DDD	580	1524	2890	1985
AAA EEE	147	674	1239	881
AAA FFF	151	682	1313	891
AAA GGG	482	1297	2465	1690
AAA HHH	755	1805	3415	2349
AAA III	369	1117	2127	1458
AAA JJJ	559	1396	2649	1818
AAA KKK	461	1214	2308	1532
AAA LLL	330	970	1852	1265
AAA MMM	149	633	1222	828
AAA NNN	178	688	1327	901
AAA OOO	300	914	1748	1153
AAA PPP	182	695	1337	908
AAA RRR	1644	3593	6761	4670
000 AAA	517	1452	2754	1891
000 CCC	153	804	1542	1050
000 DDD	353	1117	2127	1456
000 EEE	455	1277	2427	1664
000 FFF	553	1459	2768	1900
000 GGG	434	1236	2354	1613
000 HHH	259	912	1744	1190
000 III	244	914	1748	1193
000 JJJ	233	819	1570	1070
000 KKK	422	1171	2228	1526
000 LLL	187	734	1410	959
000 MMM	530	1372	2604	1787
000 NNN	695	1678	3179	2185
000 OOO	436	1197	2277	1560
000 PPP	337	1013	1932	1321
000 RRR	2078	8186		
CCC AAA	539	1493	2830	1944
CCC BBB	153	804	1542	1050
CCC DDD	202	836	1602	1091
CCC EEE	438	1245	2367	1623
CCC FFF	612	1569	2973	2043
CCC GGG	572	1495	2834	1946
CCC HHH	360	1109	2096	1434
CCC III	184	803	1539	1048
CCC JJJ	366	1104	2103	1439
CCC KKK	303	949	1814	1239
CCC LLL	236	825	1581	1077
CCC MMM	508	1331	2528	1734
CCC NNN	704	1696	3210	2207
CCC OOO	540	1390	2639	1811
CCC PPP	280	1093	2082	1429
CCC RRR	2172			
000 AAA	588	1524	2890	1985
000 BBB	353	1117	2127	1456
000 CCC	202	836	1602	1091
000 EEE	453	1214	2308	1582
000 FFF	698	1668	3161	2173
000 GGG	747	1761	3332	2291
000 HHH	548	1390	2639	1811
000 III	235	838	1605	1094

LAST MODIF: 00/01/10 14:10:27.00

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C O S T P E R S T A G E

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BITPTA CASS - FILE 10:FAA\_0001

PR TO	NR	DC9	707	727
DOO JJJ	585	1415	2684	1842
DOO RRR	179	859	1271	862
DOO LLL	370	1015	1936	1323
DOO MMM	504	1264	2402	1637
DOO NNN	722	1669	3161	2173
DOO OOO	678	1589	3012	2069
DOO PPP	474	1208	2298	1574
DOO RRR	267	8735		
EEE AAA	147	674	1299	881
EEE BBB	455	1277	2427	1664
EEE CCC	438	1245	2367	1623
EEE DDD	453	1214	2308	1582
EEE EEE	290	881	1685	1149
EEE GGG	548	1361	2583	1772
EEE HHH	711	1664	3151	2166
EEE III	258	847	1623	1108
EEE JJJ	558	1335	2535	1738
EEE KKK	315	883	1689	1152
EEE LLL	276	810	1553	1058
EEE MMM	74	434	850	570
EEE NNN	272	803	1539	1043
EEE OOO	386	1015	1936	1323
EEE PPP	179	829	1215	823
EEE RRR	1829	3603	7154	4943
FFF AAA	151	682	1313	891
FFF BBB	553	1459	2768	1900
FFF CCC	612	1569	2973	2043
FFF DDD	698	1669	3161	2173
FFF EEE	298	881	1685	1149
FFF GGG	388	1053	2026	1366
FFF HHH	760	1755	3321	2284
FFF IJJ	486	1238	2354	1613
FFF JJJ	529	1281	2434	1658
FFF KKK	593	1400	2656	1823
FFF LLL	380	1003	1915	1309
FFF MMM	300	855	1638	1115
FFF NNN	244	750	1441	980
FFF OOO	203	674	1299	881
FFF PPP	233	730	1403	954
FFF RRR	1948	3320	6249	4315
GGG AAA	482	1297	2465	1690
GGG BBB	434	1236	2354	1613
GGG CCC	572	1495	2834	1946
GGG DDD	747	1761	3322	2291
GGG EEE	548	1361	2583	1772
GGG FFF	388	1063	2026	1386
GGG GGG	509	1288	2448	1678
GGG HHH	538	1372	2604	1787
GGG IJJ	251	763	1466	937
GGG JJJ	734	1882	3147	2163
GGG KKK	286	1015	1936	1323
GGG LLL	601	1415	2684	1842
GGG MMM	628	1465	2776	1907
GGG NNN	186	843	1240	840
GGG OOO	372	988	1807	1289
GGG PPP	1890	2545	6670	4607

BITFPA CASS - FILE ID:FAA\_0001 \*\*\*\*\* C O S T P E R S T A G E \*\*\*\*\* LAST MODIF: 80/01/10 14:18:37.00

PR	TO	MM	DC9	707	727
MM AAA	755	1805	3415	2349	
MM BBB	258	912	1744	1190	
MM CCC	360	1100	2096	1434	
MM DDD	548	1290	2639	1811	
MM EEE	711	1684	3151	2166	
MM FFF	760	1755	3321	2284	
MM GGG	509	1288	2448	1678	
MM III	501	1303	2475	1637	
MM JJJ	260	780	1497	1019	
MM KKK	661	1526	2893	1907	
MM LLL	435	1136	2106	1431	
MM MMM	785	1757	3325	2287	
MM NNN	935	2036	3847	2649	
MM OOO	537	1407	2670	1833	
MM PPP	573	1363	2587	1775	
MM RRR	2200	1117	2127	1456	
MM SSS	369	914	1748	1193	
MM TTT	244	803	1539	1048	
MM UUU	184	838	1605	1094	
MM VVV	235	847	1623	1106	
MM WWW	256	1238	2354	1613	
MM XXX	466	1372	2604	1787	
MM YYY	538	1303	2475	1637	
MM ZZZ	501	1128	2145	1468	
MM AAA	430	700	1347	915	
MM BBB	201	607	1173	734	
MM CCC	151	929	1778	1212	
MM DDD	324	1303	2475	1697	
MM EEE	525	1156	2234	1509	
MM FFF	447	771	1480	1007	
MM GGG	239	7931			
MM HHH	2036	1396	2649	1818	
MM III	559	819	1570	1070	
MM JJJ	233	1104	2103	1439	
MM KKK	386	1415	2684	1842	
MM LLL	535	1335	2535	1738	
MM MMM	538	1281	2434	1668	
MM NNN	579	763	1466	997	
MM OOO	251	780	1497	1019	
MM PPP	260	1126	2145	1468	
MM RRR	430	1420	2695	1850	
MM SSS	628	810	1553	1058	
MM TTT	300	1617	3064	2105	
MM UUU	628	896	1713	1168	
MM VVV	734	974	1859	1270	
MM WWW	346	3967	7461	5155	
MM XXX	1941	1214	2308	1582	
MM YYY	461	1171	2228	1526	
MM ZZZ	422	949	1814	1239	
MM AAA	303	659	1271	862	
MM BBB	179	803	1689	1152	
MM CCC	315	1400	2650	1823	
MM DDD	593	734	1662	3147	
MM EEE	661	1526	2893	1987	



LAST MODIF: 00/01/10 14:10:27.00

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C O S T P E R S T A G E

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MUTPA CASS - FILE ID:FAA\_0001

PR TO	NR	DC9	707	727
NRK III	201	700	1247	915
NRK JJJ	828	1420	2695	1850
NRK LLL	351	905	1730	1181
NRK MMM	549	1316	2489	1707
NRK OOO	624	1413	2681	1840
NRK PPP	397	990	1691	1292
NRK XXX	3144		8167	
LLL AAA	320	970	1852	1265
LLL BBB	107	734	1410	959
LLL CCC	236	825	1581	1072
LLL DDD	370	1015	1936	1323
LLL EEE	278	810	1553	1058
LLL FFF	380	1003	1915	1309
LLL GGG	386	1015	1936	1323
LLL HHH	435	1108	2106	1441
LLL III	151	607	1173	794
LLL JJJ	300	810	1553	1058
LLL KKK	351	905	1730	1181
LLL LLL	351	905	1730	1181
LLL MMM	508	1197	2277	1560
LLL NNN	311	830	1591	1084
LLL OOO	153	536	1041	703
LLL PPP	1935	3956	7440	5141
LLL XXX	149	633	1222	828
MMM AAA	530	1372	2604	1787
MMM BBB	508	1231	2528	1734
MMM CCC	504	1264	2402	1647
MMM DDD	74	434	850	570
MMM EEE	300	855	1636	1115
MMM FFF	601	1315	2604	1842
MMM GGG	785	1757	3325	2287
MMM HHH	324	928	1778	1212
MMM JJJ	628	1420	2695	1850
MMM KKK	356	903	1727	1178
MMM LLL	351	905	1730	1181
MMM MMM	219	659	1271	862
MMM NNN	430	1052	2005	1371
MMM OOO	244	706	1358	922
MMM PPP	1799	3703	6968	4812
MMM XXX	179	689	1327	901
MMM AAA	695	1578	3179	2185
MMM BBB	704	1698	3210	2207
MMM CCC	722	1669	3181	2173
MMM DDD	272	803	1539	1048
MMM EEE	244	750	1441	980
MMM FFF	628	1485	2778	1907
MMM GGG	935	2036	3847	2649
MMM HHH	525	1303	2475	1697
MMM JJJ	734	1617	3064	2105
MMM KKK	508	1310	2489	1707
MMM LLL	508	1197	2277	1560
MMM MMM	219	658	1271	862
MMM NNN	442	1074	2047	1400
MMM OOO	362	925	1769	1207
MMM PPP	1509	3312	6235	4305
MMM XXX				

LAST MODIF: 80/01/18 14:18:37.00

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C O S T P E R S T A G E

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BITITA CASS - FILE ID:FAA\_0001

PR TO	MM	DC9	707	727
000 AAA	300	914	1748	1193
000 BBB	456	1137	2277	1550
000 CCC	540	1390	2639	1811
000 DDD	679	1589	3012	2069
000 EEE	388	1015	1936	1323
000 FFF	203	674	1299	881
000 GGG	186	643	1240	840
000 HHH	597	1407	2670	1833
000 III	447	1158	2204	1509
000 JJJ	346	896	1713	1169
000 KKK	624	1413	2681	1870
000 LLL	311	830	1591	1084
000 MMM	430	1052	2005	1371
000 NNN	442	1074	2047	1400
000 OOO	229	678	1306	886
000 PPP	1642	3411	6420	4433
000 AAA	162	695	1337	908
000 BBB	337	1013	1932	1321
000 CCC	380	1093	2082	1425
000 DDD	474	1208	2298	1574
000 EEE	178	629	1215	823
000 FFF	233	730	1403	954
000 GGG	372	989	1887	1289
000 HHH	573	1363	2587	1775
000 III	239	771	1480	1007
000 JJJ	388	974	1859	1270
000 KKK	397	990	1891	1292
000 LLL	153	536	1041	703
000 MMM	244	706	1358	922
000 NNN	362	925	1769	1207
000 OOO	229	678	1306	886
000 AAA	1800	3705	6970	4815
000 AAA	1684	3593	6761	4670
000 BBB	2078	8188	8188	8188
000 CCC	2172	8515	8515	8515
000 DDD	2267	8735	8735	8735
000 EEE	1826	3803	7154	4943
000 FFF	1569	3320	6249	4315
000 GGG	1690	3543	6670	4607
000 HHH	2200	8446	8446	8446
000 III	2036	7931	7931	7931
000 JJJ	1941	3967	7461	5155
000 KKK	2144	8167	8167	8167
000 LLL	1935	3956	7440	5141
000 MMM	1799	3703	6966	4812
000 NNN	1589	3312	6235	4305
000 OOO	1642	3411	6420	4433
000 PPP	1800	3705	6970	4815

AD-A085 438

ECON INC PRINCETON NJ

F/G 1/2

THE ALLOCATION OF RUNWAY SLOTS BY AUCTION. VOLUME II. THE AIRLI--ETC(U)

APR 80 F M SAND, M L BALINSKI

DOT-FA79WA-4374

UNCLASSIFIED

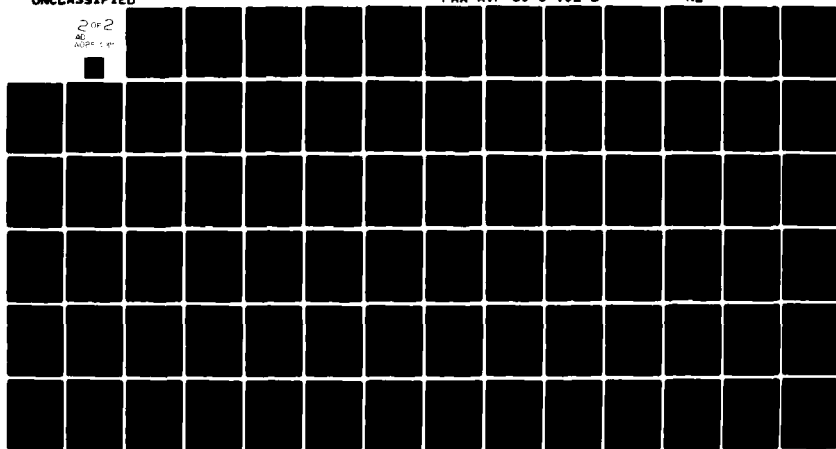
FAA-AVP-80-3-VOL-2

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2 of 2

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ADP-1-80



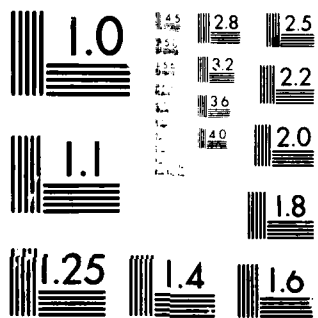
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DATE

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7-80

DTIC



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

## TABLE 3.3 AIRPORT DATA

NET-FTA CASS FILE ID:FAA\_0001

UNIVERSE FILE PRINTOUT

LAST MODIFIED 86/01/10 14:18:37.00

ID	CITY NAME	MARKET SERVED	LATITUDE DD:MM:SS	LONGITUDE DD:MM:SS	TIME ZONE	CONN TIME	BASIC TIME	BASIC COST	SEAT COST	REST SEAT CODE
AAA	ALPHA	AAA	41:02:00	82:00:00	2	30	12	0	0.00	0
BBB	BRAVO	BBB	36:00:00	79:00:00	1	25	14	0	0.00	0
CCC	CHARLIE	CCC	38:00:00	77:00:00	1	25	14	0	0.00	0
DDD	DELTA	DDD	41:00:00	75:00:00	1	25	10	0	0.00	0
EEE	ECHO	EEE	42:00:00	85:00:00	2	20	8	0	0.00	0
FFF	FOXTROT	FFF	39:00:00	90:00:00	2	20	8	0	0.00	0
GGG	GOLF	GGG	33:00:00	87:00:00	2	20	8	0	0.00	0
HHH	HOTEL	HHH	32:00:00	77:00:00	1	20	8	0	0.00	0
III	INDIA	III	40:00:00	80:00:00	1	20	10	0	0.00	0
JJJ	JULIET	JJJ	33:00:00	82:00:00	1	10	5	0	0.00	1
KKK	KILO	KKK	43:00:00	78:00:00	1	10	5	0	0.00	1
LLL	LIMA	LLL	38:00:00	82:00:00	1	10	5	0	0.00	1
MMM	MINE	MMM	43:00:00	86:00:00	2	10	5	0	0.00	1
NNN	NOVEMBER	NNN	43:00:00	91:00:00	2	10	5	0	0.00	1
OOO	OSCAR	OOO	36:00:00	88:00:00	2	10	5	0	0.00	1
PPP	PAPA	PPP	39:00:00	85:00:00	2	10	5	0	0.00	1
RRR	RAY	RRR	30:00:00	120:00:00	4	35	12	0	0.00	0

## TABLE 3.4 INITIAL SCHEDULES





FLIGHT SCHEDULES

[illegible]

## FLIGHT SCHEDULES

[illegible]

## FLIGHT SCHEDULES

[illegible]

## FLIGHT SCHEDULES

[illegible]

## FLIGHT SCHEDULES

## WITTEA CASS INITIAL

TO PORTROT	FFF 2	TO GOLF	GGG 2	TO HOTEL	MMH 1	TO INDIA	LLL 1
FR CHARLIE	CCC 1	FR CHARLIE	CCC 1	FR DELTA	DDD 1	FR DELTA	DDD 1
13:59 15:47	GL 601 DC9 1	13:35 14:14	RD0320 727 0	17:33 18:50	GL 823 727 1	12:15 15:35	GR 62 DC9 2
18:50 18:51	BL 242 727 1	8:30 13:58	BL 210 B88 BL 272	18:00 19:27	WT 18 DC9 0	14:00 14:52	GL1402 DC9 0
21:57 23:35	GL 602 DC9 1	11:09 13:58	BL 214 B88 BL 272	FR ECHO	EEE 2	FR ECHO	EEE 2
CONNECTIONS		FR DELTA	CAB 98.03 DDP 1	CONNECTIONS		10:27 12:08	CAB 48.97 DC9 0
0:00 11:06	BL 721 AAA BL 240	12:25 14:14	RD0320 727 1	11:51 15:33	BL 221 AAA BL 281	11:57 12:44	WT 301 DC9 0
13:48 19:38	BL 211 B88 BL 273	FR HOTEL	CAS 74.25 MMH 1	FR GOLF	GGG 2	FR JULIES	CAB 66.26 JJJ 1
16:19 19:36	BL 792 AAA BL 273	17:12 18:08	RD0032 DC9 1	7:11 8:54	RD0030 DC9 1	20:40 21:01	GL 924 DC9 2
21:31 1:35	BL 743 AAA BL 244	FR JULIET	CAB 48.47 JJJ 1	9:12 9:54	RD0030 DC9 0	FR LIMA	CAB 38.48 LLL 1
FR DELTA	CAB 93.12 DDD 1	18:21 18:06	RD0032 DC9 0	FE KILG	CAB 89.43 KKK 1	8:04 10:28	GR 41 DC9 1
17:50 18:51	BL 242 727 0	TO HOTEL	MMH 1	13:34 15:59	GR 42 DC9 1	9:15 11:09	GR 21 DC9 1
CONNECTIONS		FR ECHO	CAB 42.47 PFF 2	13:40 15:59	GR 62 DC9 1	13:34 15:59	GR 42 DC9 1
0:00 13:30	BL 260 AAA BL 271	15:57 17:36	BL 273 727 1	15:56 18:01	GL 140 727 2	13:40 15:59	GR 62 DC9 1
13:16 19:36	BL 261 B38 BL 273	21:56 23:35	BL 244 727 1	TO INDIA	LLL 1	16:38 18:01	BL 382 727 0
15:10 18:36	BL 291 AAA BL 273	FR BRAVO	CAB 49.27 BBB 1	FR ALPHA	AAA 2	11:00 13:23	RD0011 727 0
FR ECHO	CAB 42.47 PFF 2	6:30 9:54	RD0030 DC9 2	7:00 11:09	GR 21 DC9 2	15:08 18:41	GL 601 DC9 2
15:57 17:36	BL 273 727 1	8:00 8:53	BL 270 727 0	8:25 10:29	GR 41 DC9 0	16:38 18:01	BL 382 727 0
21:56 23:35	BL 244 727 1	10:30 11:31	RD0041 DC9 0	12:30 16:39	GR 22 DC9 2	FR BRAVO	CAB 46.96 BBB 1
FR JULIET	JJJ 1	12:30 13:23	UL 821 727 0	13:55 15:59	GR 42 DC9 0	6:30 8:52	RD0030 DC9 1
20:30 23:35	GL 602 DC9 2	16:00 16:53	RD0032 DC9 0	FR BRAVO	BBB 1	9:20 10:09	GL1400 DC9 0
CONNECTIONS		18:18 17:11	RD0043 DC9 0	7:00 10:29	GR 41 DC9 2	11:01 11:50	GL 301 DC9 0
20:31 1:35	BL 282 AAA BL 244	16:25 17:10	GL1142 DC9 0	7:00 7:55	GR 51 DC9 0	16:00 18:01	RD0032 DC9 1
FR KILG	CAB 82.44 KKK 1	17:00 17:53	GL 841 727 0	8:00 10:18	WT 300 DC9 1	16:15 17:04	GL1122 DC9 0
12:43 15:47	GL 601 DC9 2	19:00 19:53	GL 804 727 0	8:00 9:03	GL 300 DC9 0	18:52 19:41	GL 601 DC9 0
TO GOLF	GGG 2	21:56 22:51	RD0045 DC9 0	FR CHARLIE	CCC 1	FR CHARLIE	CAB 61.96 CCC 1
FR ALPHA	AAA 2	FR CHARLIE	CAB 59.36 CCC 1	13:30 15:59	GR 42 DC9 2	10:40 11:50	RD0210 DC9 0
7:13 7:59	RD0010 727 0	8:45 9:53	GL1140 DC9 0	14:48 15:35	GR 52 DC9 0	13:50 16:41	GL 601 DC9 2
9:19 9:19	BL 200 727 0	15:16 17:11	RD0043 DC9 1	21:08 23:01	GL 924 DC9 1	14:05 18:15	GL 922 DC9 0
11:57 11:58	RD0012 727 0	18:43 19:50	GL 823 727 0	FR CHARLIE	CCC 1	17:55 18:05	RD0230 DC9 0
13:15 23:34	GL1223 727 0	20:50 22:51	RD0045 DC9 1	7:00 9:03	GL 300 DC9 1	FR DELTA	CAB 61.94 DDD 1
FR BRAVO	BBB 1	FR DELTA	CAB 70.15 DDD 1	10:21 11:09	GR 21 DC9 0	7:50 10:00	GL1400 DC9 1
8:30 9:51	RD0030 DC9 0	11:00 13:23	GL 821 727 1	15:51 16:39	GR 22 DC9 0	9:30 11:50	RD0210 DC9 1
11:37 11:50	BL 272 727 0	12:15 13:42	WT 9 DC9 0	22:13 23:01	GL 924 DC9 0	12:55 15:15	GL 922 DC9 1
13:00 13:21	RD0031 DC9 0	12:45 14:12	RD0021 727 0	FR DELTA	DDD 1	14:00 17:04	GL1123 DC9 1
16:00 18:00	RD0032 DC9 0	14:55 17:10	GL1142 DC9 1	FR CHARLIE	CCC 1	18:45 18:05	RD0230 DC9 1
20:30 23:34	GL1223 727 1	15:22 17:53	GL 841 727 1	8:30 7:09	RD0300 727 0	FR PORTROT	CAB 70.26 PFF 2



# FIGURE SCHEMULES

BUTTE PASS INITIAL		F L I G H T S	
TO PAPA	PPP 2	TO XRAY	XXA 4
FR ALPHA	AAA 2	FR CHARLIE	CCC 1
CAB 41:58		15:30 19:14	GR 902 727 1
0:14 9:52	BL 200 727 0	CONNECTIONS	
13:08 13:46	BL 252 727 0	16:24 0:47	BL 723 AAA BL 791
		16:48 0:47	BL 751 AAA BL 791
FR BRAVO	BBB 1	FR DELTA	DDD 1
CAB 57:07		CAB 249:87	
CONNECTIONS		CONNECTIONS	
11:46 15:46	BL 794 AAA BL 252	15:10 22:32	BL 291 AAA BL 792
12:12 15:46	BL 231 AAA BL 252	16:37 0:47	BL 262 AAA BL 791
FR CHARLIE	CCC 1		
CAB 61:36			
CONNECTIONS			
0:09 11:52	BL 721 AAA BL 200		
9:00 11:52	BL 740 AAA BL 200		
12:12 15:46	BL 722 AAA BL 252		
FR DELTA	DDD 1		
CAB 70:75			
CONNECTIONS			
0:00 11:52	BL 260 AAA BL 200		
FR GOLF	GGG 2		
CAB 80:58			
CONNECTIONS			
11:39 15:46	BL 380 AAA BL 252		
FR NOVEMBER	NNN 2		
CAB 59:56			
12:11 13:46	BL 252 727 1		
FR OSCAR	OOO 2		
CAB 46:28			
0:00 0:52	BL 200 727 1		
TO XRAY	XXA 4		
FR ALPHA	AAA 2		
CAB 191:53			
0:00 10:14	GR 701 727 0		
16:18 10:32	BL 752 707 0		
17:00 19:14	GR 902 727 0		
18:33 20:47	BL 791 707 0		
FR BRAVO	BBB 1		
CAB 230:99			
17:36 20:47	BL 791 707 1		
CONNECTIONS			
14:56 22:32	BL 211 CCC BL 792		
FR CHARLIE	CCC 1		
CAB 240:38			
0:55 10:14	GR 701 727 1		
16:30 19:22	BL 703 707 1		

## AIRPORT ACTIVITY PROFILE FOR STATION AAA

## WITFTA CASS

TIME O FLIGHT EQ	TIME O FLIGHT EQ	TIME O FLIGHT EQ	TIME O FLIGHT EQ
0:54 A BL 793 707	9:14 D BL 200 727	13:57 A GR 52 DC9	17:50 D RD0023 727
0:25 D GL 500 727	9:25 D GR 11 DC9	13:57 D GR 303 727	17:55 D GR 103 727
0:30 D GR 301 727	9:29 A RD0018 727	14:07 A BL 790 707	18:00 D GR 23 DC9
0:30 D GR 501 727	9:32 D GR 801 727	14:07 D GR 503 727	18:00 D GR 402 727
0:30 D RD0010 727	10:00 A BL 290 727	14:13 A RD0011 727	18:13 A BL 791 707
0:37 A GL 600 DC9	10:12 A GR 201 727	14:17 D GR 52 DC9	18:14 A BL 203 727
0:45 D GR 201 727	10:25 A BL 251 727	14:24 A GR 202 727	18:27 D BL 263 727
0:57 D GL 600 DC9	10:25 A BL 711 707	14:27 D BL 790 707	18:33 D BL 791 707
1:00 D BL 711 707	10:31 A BL 251 727	14:38 A GL 601 DC9	18:33 D BL 203 727
1:00 D GR 21 DC9	10:45 D BL 251 727	14:39 A BL 712 707	18:39 A GR 203 727
1:00 D GR 31 DC9	10:51 D BL 221 727	14:51 A GR 802 727	18:51 A BL 713 707
1:11 D GL 100 727	10:55 D GL1201 727	14:52 A BL 291 727	18:58 A BL 274 727
1:30 A GR 401 727	10:59 A BL 280 727	15:08 D GL 601 DC9	19:06 A BL 292 727
1:34 A GR 701 727	11:00 D RD0011 727	15:10 D GR 203 727	19:07 A GL 102 727
1:35 A GL1220 727	11:12 D BL 712 707	15:11 D GR 802 727	19:18 D BL 274 727
1:39 A BL 721 707	11:21 D BL 291 727	15:12 A BL 253 727	19:25 D GR 204 727
1:50 D GR 401 727	11:21 A BL 794 707	15:24 D BL 713 707	19:29 A RD0012 727
1:50 D RD0020 727	11:27 A BL 750 707	15:32 D BL 253 727	19:36 D BL 714 707
1:55 D GL1220 727	11:37 A GR 901 727	15:42 A GL1222 727	19:50 A BL 255 727
1:59 D BL 721 707	11:41 A GR 31 DC9	15:45 D BL 292 727	19:51 A BL 282 727
8:00 D BL 280 727	11:41 A GR 31 DC9	15:51 A GR 603 727	20:10 D BL 255 727
8:00 D BL 750 707	11:45 D BL 281 727	15:53 A BL 281 727	20:13 A BL 243 727
8:00 D BL 794 707	11:47 A BL 231 727	15:56 A BL 792 707	20:15 A BL 724 707
8:00 D GR 701 727	11:51 A GL 722 707	16:02 D GL1222 727	20:33 D BL 243 727
8:05 A GR 41 DC9	12:00 D GR 901 727	16:03 A BL 723 707	20:33 A BL 752 707
8:07 A BL 240 727	12:06 D BL 795 707	16:09 A GR 902 727	20:39 A GR 304 727
8:07 A BL 250 727	12:07 D BL 231 727	16:11 D GR 12 DC9	20:55 A GL1223 727
8:08 A GR 601 727	12:11 D BL 722 707	16:18 D BL 793 707	20:59 A GR 504 727
8:10 A BL 220 727	12:19 A BL 201 727	16:23 D BL 723 707	21:10 A BL 743 707
8:25 D GR 41 DC9	12:30 D GR 22 DC9	16:27 A BL 751 707	21:15 D GL1223 727
8:27 D BL 240 727	12:30 D GR 32 DC9	16:30 D GR 604 727	21:30 D BL 743 707
8:27 D BL 250 727	12:30 D BL 201 727	16:30 D RD0012 727	21:39 A WT 503 DC9
8:27 A GR 51 DC9	12:39 D BL 102 727	16:37 A BL 273 727	22:10 A GL 903 727
8:30 D BL 220 727	12:46 A BL 252 727	16:37 A GR 702 727	22:36 A BL 244 727
8:30 D BL 290 727	12:48 A BL 252 727	16:38 D BL 282 727	22:36 A GL 602 DC9
8:34 A GR 101 727	12:52 A BL 222 727	16:50 A GL 902 727	22:52 A GR 204 727
8:39 A BL 740 707	12:52 A BL 741 707	16:57 D BL 273 727	22:54 A GR 23 DC9
8:39 A WT 1 DC9	12:58 D GL 101 727	16:58 A BL 742 707	22:56 D BL 244 727
8:39 A WT 2 DC9	13:00 D BL 751 707	17:00 D GR 702 727	22:56 D GL 602 DC9
8:42 A BL 260 727	13:06 D GR 102 727	17:00 D GR 902 727	23:00 D WT5038 DC9
8:47 D GR 51 DC9	13:08 D BL 252 727	17:09 A GR 103 727	
8:53 D GR 602 727	13:09 A GL 901 727	17:10 D GL 902 727	
8:54 A BL 200 727	13:12 D BL 222 727	17:11 A GR 22 DC9	
8:54 D GR 101 727	13:12 D BL 741 707	17:12 D BL 752 707	
8:59 D BL 740 707	13:12 A GR 302 727	17:18 D BL 742 707	
8:59 D WT 1 DC9	13:15 A GL1231 727	17:27 A BL 254 727	
8:59 D WT 2 DC9	13:22 A GR 502 727	17:30 A RD0022 727	
9:02 D BL 260 727	13:29 D GL 901 727	17:31 A GR 32 DC9	
9:05 A GR 11 DC9	13:35 A GR 42 DC9	17:39 A GR 402 727	
9:07 A GL1200 727	13:36 D GL1221 727	17:42 A BL 262 727	
9:12 A GR 801 727	13:55 D GR 42 DC9	17:47 D BL 254 727	



# REPORT ACTIVITY PROFILE FOR STATION AAA

DATE: 01/01/01

REPORT: 01/01/01

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	0	0	0	0	0	7	13	27	0	10	12	13	15	10	12	15	15	10	0	0	4	7	1

## AIRPORT ACTIVITY PROFILE FOR STATION DBB

## BITPTA CASS

TIME O FLIGHT EQ	TIME O FLIGHT EQ	TIME O FLIGHT EQ	TIME O FLIGHT EQ
8:00 D GR 601 727	12:00 D RD0031 DC9	17:07 D BL 262 727	23:03 A WT 400 DC9
8:30 D RD0030 DC9	12:01 A GL 801 727	17:12 A GR 42 DC9	
8:55 D GR 401 727	12:10 A GL 821 727	17:12 A GR 52 DC9	
8:59 D BL 200 727	12:15 D GL1141 DC9	17:37 A GR 602 727	
	12:16 A BL 241 727	17:38 D BL 791 707	
7:00 D GR 41 DC9	12:17 A GR 302 727	17:57 D GR 43 DC9	
7:00 D GR 51 DC9	12:18 D GR 801 727	17:57 D GR 802 727	
7:30 D BL 230 727	12:30 D GL 821 727		
7:35 A RD0040 DC9	12:30 D GR 42 DC9	18:00 D WT 500 DC9	
7:40 A GL 300 DC9	12:30 D GR 52 DC9	18:06 A GR 503 727	
7:55 D RD0040 DC9	12:36 D BL 241 727	18:11 A BL 292 727	
	12:37 D GR 302 727	18:15 A BL 233 727	
8:00 D BL 370 727		18:28 A GL1222 727	
8:00 D WT 300 DC9	13:00 D GL 802 727	18:31 D BL 292 727	
8:08 D GL 300 DC9	13:15 A RD0042 DC9	18:32 A GL 601 DC9	
8:18 A GR 11 DC9	13:26 A BL 261 727	18:35 A GL 804 727	
8:18 A BL 210 727	13:28 A GL 402 727	18:46 A GL1124 DC9	
8:25 A GL 800 727	13:35 D RD0042 DC9	18:51 D GR 504 727	
8:30 D GR 11 DC9	13:36 A BL 211 727	18:52 D GL 601 DC9	
8:38 D BL 210 727	13:39 A GR 401 727	18:55 A RD0044 DC9	
8:51 A GL 900 727	13:46 D BL 261 727	18:58 A BL 213 727	
8:56 A GR 301 727	13:56 D BL 211 727		
9:00 D GL 800 727	14:15 D GL 404 727	19:00 D GL 804 727	
9:00 A GL1400 DC9	14:20 A GR 62 DC9	19:08 D GL1124 DC9	
9:01 A GL 400 727	14:24 D GR 402 727	19:15 D RD0044 DC9	
9:05 A GR 61 DC9	14:30 A BL 272 727	19:18 D BL 213 727	
9:18 D GR 301 727	14:33 A BL 231 727	19:38 A BL 752 707	
9:20 D BL1400 DC9	14:40 D GR 62 DC9	19:44 A GR 304 727	
9:21 D BL 240 727	14:46 A GL 322 DC9	19:51 A GR 43 DC9	
9:25 D GR 61 DC9	14:53 A RD0031 DC9	19:58 D BL 752 707	
9:35 A GL1120 DC9	14:56 A GR 12 DC9		
10:00 A BL 270 727	15:08 D GL 322 DC9	20:04 D GR 304 727	
10:05 D GL 900 727	15:10 A GL1122 DC9	20:08 A GL1205 727	
10:10 A RD0041 DC9	15:15 D BL 273 727	20:26 D GL1223 727	
10:26 A BL 794 707	15:16 D GR 12 DC9	20:26 A GR 402 727	
10:27 A BL 230 727	15:18 D BL 233 727	20:29 A GR 604 727	
10:29 A GR 501 727	15:38 A BL 741 707	20:48 A RD0032 DC9	
10:30 D GL1121 DC9	15:58 A RD0043 DC9	20:48 D BL 224 727	
10:38 D RD0041 DC9		20:48 A GL 924 DC9	
10:41 A GL 301 DC9	16:00 D RD0032 DC9	20:48 K GL 902 727	
10:48 D BL 794 707	16:05 A GL1142 DC9	20:53 A BL 263 727	
10:57 A BL 214 727	16:15 D GL1122 DC9		
11:01 D GL 301 DC9	16:18 D RD0043 DC9	21:06 D GL 924 DC9	
11:09 A RD0030 DC9	16:23 D BL 742 707	21:13 D BL 263 727	
11:12 D BL 231 727	16:23 A GR 303 727	21:35 D GL 903 727	
11:14 D GR 502 727	16:25 D GL1142 DC9	21:38 A RD0045 DC9	
11:17 D BL 214 727	16:32 A GL 841 727	21:56 A GR 104 727	
11:27 D BL 272 727	16:43 D GR 303 727	21:58 D RD0045 DC9	
11:32 A GR 41 DC9	16:47 A BL 262 727	21:59 A GR 23 DC9	
11:42 A GR 51 DC9	16:53 A BL 790 707	22:16 D GR 104 727	
11:55 A GL1141 DC9		22:18 D GR 23 DC9	
11:56 A GR 801 727	17:00 D GL 841 727	22:29 A BL 274 727	
	17:00 D GL1403 DC9		
		23:02 A WT 500 DC9	

MUTPA CASS

## AIRPORT ACTIVITY PROFILE FOR STATION 800

## PROFILE SUMMARY

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0	0	0	0	0	0	4	6	10	9	11	10	12	9	9	7	12	9	13	8	11	7	3	2

## AIRPORT ACTIVITY PROFILE FOR STATION CCC

## DELTA CASS

TIME O FLIGHT EQ	TIME O FLIGHT EQ	TIME O FLIGHT EQ	TIME O FLIGHT EQ
6:20 D R00300 727	11:59 A GL1401 DC9	16:20 D GR 103 727	22:04 A BL 714 707
6:56 D GR 761 727	12:03 A BL 214 727	16:40 A GR 402 727	22:13 D GL 924 DC9
7:00 D BL 721 707	12:07 D GR 103 727	16:50 D BL 242 727	23:02 A GR 104 727
7:00 D GL 300 DC9	12:13 D BL 741 707	17:00 D GR 402 727	23:58 A BL 743 707
7:30 D BL 210 727	12:13 D GR 11 DC9	17:05 D BL 223 727	
7:34 A R00300 DC9	12:19 D GL1401 DC9	17:15 D GL 102 727	
7:54 D R00200 DC9	12:20 A GL 402 727	17:25 A BL 212 727	
7:55 D GR 101 727	12:30 D GL 901 727	17:28 A R00330 727	
8:00 D BL 740 727	12:32 A GR 602 727	17:38 A GR 203 727	
8:26 A GL1140 DC9	12:40 D GL 402 727	17:52 A BL 713 707	
8:35 A GL 400 727	12:48 D BL 211 727	17:55 D R00230 DC9	
8:39 A WT 3 DC9	13:15 A R00320 727	18:00 D GR 203 727	
8:41 A R00040 DC9	13:17 D GR 603 727	18:01 A WT 100 DC9	
8:46 D GL1140 DC9	13:23 A GL1201 727	18:05 A GL 405 727	
8:59 A GL 820 727	13:25 A GR 202 727	18:10 D BL 213 727	
8:59 D WT 3 DC9	13:35 D R00320 727	18:12 D BL 713 707	
9:13 A GR 201 727	13:39 A GL 601 DC9	18:21 D WT 100 DC9	
9:19 D GL 820 727	13:40 A BL 712 707	18:23 A GL 823 727	
9:24 A BL 210 727	13:44 A R00220 DC9	18:39 A GR 12 DC9	
9:26 A GL 920 DC9	13:45 A GL 922 DC9	18:43 D GL 823 727	
9:28 A BL 711 707	13:45 D GR 202 727	18:43 A GR 43 DC9	
9:30 D R00041 DC9	13:59 D GL 601 DC9	18:51 A BL 723 707	
9:33 D GR 201 727	14:00 D BL 712 707	18:59 A GL1142 DC9	
9:39 A GL 100 727	14:00 D GL1201 727	18:59 D GR 12 DC9	
9:45 D GL 401 727	14:04 D R00220 DC9	19:00 D GL 406 727	
9:46 D GL 920 DC9	14:05 D GL 922 DC9	19:00 A GL1205 727	
9:48 D BL 711 707	14:21 A R00042 DC9	19:03 D GR 43 DC9	
9:50 D GL 100 727	14:28 A GR 901 727	19:18 D GL1142 DC9	
10:01 A GR 21 DC9	14:34 A BL 705 707	19:20 D GL1205 727	
10:09 D BL 214 727	14:39 A BL 722 707	19:28 A GR 702 727	
10:09 A GL 600 DC9	14:42 A BL 211 727	19:36 D BL 724 707	
10:18 A GR 31 DC9	15:01 A GL 404 727	19:38 A GL 902 727	
10:18 A GR 401 727	15:10 D R00043 DC9	19:45 A GL 323 DC9	
10:20 A R00310 DC9	15:19 D BL 792 707	19:46 A BL 742 707	
10:21 D GR 21 DC9	15:21 D GL 404 727	20:00 D GL 902 727	
10:23 A GL1220 727	15:23 D BL 723 707	20:01 A R00044 DC9	
10:27 A BL 721 707	15:26 A GL 101 727	20:04 A BL 213 727	
10:28 A BL 750 727	15:27 D BL 212 727	20:23 A GR 103 727	
10:28 A R00310 727	15:28 A BL 751 707	20:31 D BL 743 707	
10:29 D GR 31 DC9	15:30 D GR 902 727	20:50 D R00045 DC9	
10:30 D GR 401 727	15:31 A GR 22 DC9	20:50 A WT 102 DC9	
10:40 D R00210 DC9	15:34 A GR 102 727	21:08 D GR 104 727	
10:40 D BL 750 707	15:37 A GL 822 727	21:10 D WT 102 DC9	
10:40 D R00310 727	15:45 A GR 32 DC9	21:32 A BL 224 727	
11:00 D GL 600 DC9	15:48 D BL 751 707	21:34 A GL 602 DC9	
11:00 D GL1220 727	15:51 D GR 32 DC9	21:52 D BL 224 727	
11:01 A GL 900 727	15:52 A GL 322 DC9	21:52 A GL 924 DC9	
11:12 D BL 722 727	16:00 D GL 922 727	21:53 A GR 204 727	
11:22 A GR 101 727	16:12 D GL 322 DC9	21:53 D GL 602 DC9	
11:27 A BL 740 707	16:15 D GR 32 DC9		
11:53 A GR 11 DC9	16:30 A BL 242 727		

AIRPORT ACTIVITY PROFILE FOR STATION CCG

WETFA CASS

PROFILE SUMMARY

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0	0	0	0	0	0	2	6	8	12	16	8	10	11	9	16	8	8	13	10	7	8	3	2

## TABLE 3.5 TRAFFIC DATA

00/01/31 13:11:03.00

BUTTA CASE		INITIAL STATE		T R A F F I C D A T A									
MARKET	DIST.	PAY/DAY	XTOT	KPM/DAY	XTOT	ID	PAY/DAY	XTOT	KPM/DAY	XTOT	KPM/DAY	XTOT	KPM/DAY
AAA-BBB	517	1000.7	4.10	541.0	4.91	BL	489.1	45.01	5.45	252.9	5.66		
						CR	449.1	41.23	6.56	232.2	6.78		
						GL	148.4	13.66	2.20	76.7	3.55		
AAA-CCC	539	3276.6	0.59	1237.1	10.72	BL	981.5	43.11	10.94	529.0	11.83		
						CR	849.7	41.71	13.87	511.9	14.95		
						GL	345.5	15.18	5.12	186.2	6.82		
AAA-DDD		788.0	2.86	482.1	4.04	CR	502.5	83.94	7.34	295.5	8.83		
						BL	177.6	22.60	1.98	104.4	2.33		
						WT	63.0	8.02	4.56	37.1	8.91		
						GL	42.0	5.45	0.63	25.2	1.17		
AAA-EEE	147	298.4	1.13	43.0	0.38	BL	188.6	83.20	2.10	27.7	0.82		
						WT	60.5	20.28	4.37	6.9	2.14		
						GL	49.3	16.52	0.73	7.2	0.34		
AAA-FFF	151	185.0	0.70	28.1	0.25	BL	137.7	74.09	1.53	20.8	0.46		
						GL	48.2	25.91	0.71	7.3	0.34		
AAA-GGG	483	204.8	0.77	98.7	0.86	RD	107.2	52.33	4.19	51.7	5.31		
						BL	66.3	32.36	0.74	31.9	9.71		
						GL	31.4	15.31	0.46	15.1	0.70		
AAA-HHH	755	176.8	0.67	133.5	1.17	RD	116.6	65.97	4.56	88.1	9.06		
						BL	60.2	34.03	0.67	45.4	1.02		
AAA-III	369	90.8	0.34	33.4	0.29	CR	90.6	100.00	1.32	33.4	0.98		
AAA-JJJ	559	109.6	0.41	81.2	0.54	BL	53.0	48.39	0.59	29.6	0.86		
						RD	48.4	44.15	1.89	27.0	2.78		
						GL	8.2	7.47	0.12	4.6	0.21		
AAA-KKK	461	18.9	0.07	8.7	0.08	GL	18.9	100.00	0.28	8.7	0.40		
AAA-LLL	330	45.7	0.17	15.1	0.13	CR	45.7	100.00	0.67	15.1	0.44		
AAA-MMM	149	112.6	0.42	16.8	0.15	BL	98.1	87.09	1.09	14.6	0.32		
						GL	14.5	12.91	0.22	2.2	0.10		
AAA-NNN	179	134.5	0.51	24.1	0.21	BL	101.9	75.76	1.14	18.2	0.41		
						GL	32.6	24.34	0.48	5.8	0.27		
AAA-OOO	300	40.0	0.15	12.3	0.11	BL	40.9	100.00	0.46	12.3	0.27		
AAA-PPP	182	78.0	0.26	12.7	0.11	BL	78.0	100.00	0.76	12.7	0.26		
AAA-RRR	1804	331.1	1.25	557.6	4.87	CR	207.8	62.78	3.04	350.0	10.22		
						BL	123.3	37.24	1.37	207.7	4.84		
BBB-AAA	517	1000.7	4.09	540.8	4.90	CR	523.5	48.26	7.85	278.6	7.91		
						BL	429.7	39.61	4.78	222.2	4.97		
						GL	131.6	12.13	1.95	68.6	3.15		
BBB-CCC	153	1318.5	4.94	200.5	1.75	BL	489.1	25.79	0.23	71.8	1.00		

00/01/31 13:11:03.00

## T R A F F I C D A T A

## INITIAL STATE

## MARKET CLASS

MARKET CLASS	MARKET	DIST.	PAY/DAY	STOT KPM/DAY	STOT	ID	PAY/DAY	STOT	XCAR KPM/DAY	XCAR
000-000	383	016.0	3.08	288.4	2.52	GL	328.9	40.27	4.80	116.1
						GL	310.8	38.04	4.60	109.7
						WT	86.3	16.56	6.34	30.5
000-000	495	220.0	0.83	100.5	0.88	GL	214.3	97.03	2.39	97.8
						WT	4.6	2.06	0.33	2.1
						GL	2.0	0.91	0.03	0.9
000-000	583	105.7	0.40	58.4	0.51	GL	105.7	100.00	1.18	58.4
						WT	4.6	2.06	0.33	2.1
						GL	2.0	0.91	0.03	0.9
000-000	434	185.2	0.70	80.4	0.70	GL	107.1	57.84	4.19	46.5
						WT	48.7	26.29	0.54	21.1
						GL	29.4	15.67	0.44	12.8
000-000	299	205.3	1.00	60.7	0.60	GL	114.5	43.16	1.78	29.7
						WT	104.9	39.54	4.10	27.2
						GL	45.9	17.30	0.51	11.6
000-000	344	182.6	0.60	44.5	0.39	GL	111.4	61.04	1.63	27.2
						WT	67.4	26.90	1.00	16.4
						GL	3.8	2.06	0.27	0.9
000-000	233	188.4	0.71	43.9	0.38	GL	167.3	88.82	2.48	39.0
						WT	21.1	11.18	0.82	4.9
						GL	78.5	100.00	1.18	33.1
000-000	422	76.5	0.30	33.1	0.29	GL	78.5	100.00	1.18	33.1
						WT	85.7	100.00	1.25	16.0
						GL	84.4	100.00	0.72	44.8
000-000	187	85.7	0.32	16.0	0.14	GL	33.1	100.00	0.37	14.4
						WT	41.0	100.00	0.46	13.8
						GL	131.6	100.00	1.47	273.5
000-000	436	33.1	0.12	14.4	0.13	GL	1043.8	47.38	11.63	582.6
						WT	965.7	42.83	16.11	520.5
						GL	193.8	8.79	2.87	104.4
000-000	337	41.0	0.15	13.8	0.12	GL	438.1	34.17	4.88	67.0
						WT	388.1	30.27	5.75	59.4
						GL	234.1	18.25	3.42	35.0
000-000	2076	131.6	0.50	273.5	2.39	GL	714.5	48.00	10.58	144.3
						WT	240.0	16.12	3.51	48.5
						GL	198.1	13.31	14.31	40.0
000-000	939	2202.3	0.31	1187.6	10.38	GL	185.5	12.48	7.25	37.5
						WT	150.4	10.10	1.68	30.4
						GL	150.4	10.10	1.68	30.4



00/01/31 13:11:00.00

MUTPA CASE			INITIAL STATE			T R A F F I C D A T A									
MARKET	DIST.	PAY/DAY	STOT	KPM/DAY	STOT	ID	PAY/DAY	STOT	SCAR	KPM/DAY	STOT	SCAR	KPM/DAY	STOT	SCAR
CCC-EEE	438	147.0	0.55	64.4	0.56	BL	124.7	84.80	1.39	54.6	1.22	54.6	1.22	54.6	1.22
						GL	22.4	15.20	0.33	9.8	0.45	9.8	0.45	9.8	0.45
CCC-FFF	612	87.2	0.33	53.4	0.47	BL	61.6	70.70	0.69	37.7	0.64	37.7	0.64	37.7	0.64
						GL	25.5	29.30	0.38	15.6	0.72	15.6	0.72	15.6	0.72
CCC-GGG	972	120.1	0.45	68.7	0.60	RD	107.5	89.50	4.20	61.5	6.32	61.5	6.32	61.5	6.32
						BL	12.6	18.50	0.14	7.2	0.16	7.2	0.16	7.2	0.16
CCC-NNN	308	182.8	0.69	65.8	0.57	GL	150.8	82.51	2.23	54.3	2.51	54.3	2.51	54.3	2.51
						RD	32.0	17.48	1.25	11.5	1.18	11.5	1.18	11.5	1.18
CCC-LLL	184	112.7	0.43	20.7	0.18	GR	71.4	63.30	1.04	13.1	0.38	13.1	0.38	13.1	0.38
						GL	41.4	36.70	0.61	7.6	0.35	7.6	0.35	7.6	0.35
CCC-JJJ	286	151.0	0.57	58.3	0.51	RD	98.8	86.08	3.90	38.5	3.96	38.5	3.96	38.5	3.96
						GL	51.2	33.92	0.76	18.8	0.82	18.8	0.82	18.8	0.82
CCC-MMM	303	244.5	0.82	74.1	0.65	GL	244.5	100.00	3.82	74.1	3.43	74.1	3.43	74.1	3.43
CCC-LLL	236	74.2	0.28	17.9	0.15	GR	74.2	100.00	1.08	17.5	0.51	17.5	0.51	17.5	0.51
CCC-NNN	908	41.7	0.16	21.2	0.19	BL	41.7	100.00	0.47	21.2	0.47	21.2	0.47	21.2	0.47
CCC-NNN	704	34.3	0.13	24.2	0.21	BL	34.3	100.00	0.38	24.2	0.54	24.2	0.54	24.2	0.54
CCC-OOO	840	19.8	0.07	10.7	0.09	BL	19.8	100.00	0.22	10.7	0.24	10.7	0.24	10.7	0.24
CCC-PPP	380	38.3	0.14	14.6	0.13	BL	38.3	100.00	0.43	14.6	0.33	14.6	0.33	14.6	0.33
BOO-AAA	808	785.4	2.96	461.8	4.04	GR	349.0	44.43	5.10	205.2	5.99	205.2	5.99	205.2	5.99
						GL	200.7	25.55	2.97	118.0	5.46	118.0	5.46	118.0	5.46
						BL	159.8	20.35	1.78	94.0	2.10	94.0	2.10	94.0	2.10
						WT	75.9	9.66	5.48	44.6	10.73	44.6	10.73	44.6	10.73
BOO-BOO	253	812.1	3.06	286.7	2.50	GL	346.0	42.60	5.13	122.1	5.68	122.1	5.68	122.1	5.68
						GR	345.1	42.50	5.04	121.8	5.56	121.8	5.56	121.8	5.56
						BL	92.7	11.41	1.03	32.7	0.73	32.7	0.73	32.7	0.73
						WT	28.3	3.48	2.04	10.0	2.40	10.0	2.40	10.0	2.40
BOO-CCC	282	1320.5	4.98	266.7	2.33	GL	827.6	47.33	9.39	126.8	9.87	126.8	9.87	126.8	9.87
						WT	330.5	17.46	16.66	46.6	11.19	46.6	11.19	46.6	11.19
						RD	188.3	14.26	7.36	38.8	3.91	38.8	3.91	38.8	3.91
						GR	186.3	14.11	2.72	37.6	1.10	37.6	1.10	37.6	1.10
						BL	87.7	6.64	0.98	17.7	0.40	17.7	0.40	17.7	0.40
BOO-EEE	493	98.2	0.37	44.5	0.39	WT	59.2	60.30	4.28	26.8	6.45	26.8	6.45	26.8	6.45
						BL	38.0	39.70	0.43	17.7	0.39	17.7	0.39	17.7	0.39
BOO-FFF	698	51.6	0.19	26.6	0.21	BL	51.6	100.00	0.88	26.6	0.81	26.6	0.81	26.6	0.81
BOO-GGG	747	44.1	0.17	33.6	0.29	RD	44.1	100.00	1.72	33.6	3.39	33.6	3.39	33.6	3.39
BOO-NNN	548	118.9	0.45	65.1	0.57	GL	57.4	48.26	0.85	31.4	1.46	31.4	1.46	31.4	1.46
						WT	40.8	34.40	2.95	22.4	6.39	22.4	6.39	22.4	6.39
						RD	26.6	17.34	0.81	11.3	1.16	11.3	1.16	11.3	1.16



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INITIA CASE	INITIAL STATE			T R A F F I C D A T A									
	MARKET DIST.	PAK/DAY	STOT KPM/DAY	STOT	ID	PAK/DAY	STOT	SCAR	KPM/DAY	SCAR			
000-AAA	402	105.9	0.74	94.4	0.82	RD	107.1	54.68	4.19	51.6	5.31	0.65	0.63
					GL	50.4	30.88	0.67	29.1	13.6	0.63		
000-000	434	194.7	0.73	84.5	0.74	RD	119.7	61.45	4.88	51.9	5.34		
					GL	75.1	38.55	0.84	32.6	0.73			
000-CCC	572	132.2	0.56	75.6	0.66	RD	120.7	91.32	4.72	89.1	7.10		
					GL	11.5	8.68	0.17	6.6	0.36			
000-000	747	47.9	0.18	35.8	0.31	RD	37.3	77.89	1.48	27.9	2.85		
					GL	10.6	22.11	0.18	7.9	0.37			
000-EEE	548	14.1	0.05	7.7	0.07	GL	14.1	100.00	0.16	7.7	0.17		
000-NNN	509	4.2	0.02	2.1	0.02	RD	4.2	100.00	0.16	2.1	0.22		
000-JJJ	261	22.7	0.09	5.7	0.05	RD	22.7	100.00	0.89	5.7	0.59		
000-AAA	785	186.4	0.63	125.6	1.10	RD	85.3	51.28	3.34	64.4	6.63		
					GL	81.1	48.72	0.90	61.2	1.37			
000-000	259	236.9	0.89	61.4	0.54	RD	139.2	58.75	5.44	38.1	3.71		
					GL	77.5	32.73	1.15	28.1	0.93			
000-CCC	360	199.3	0.75	71.8	0.83	GL	188.2	84.37	2.49	60.5	2.80		
					RD	26.7	13.40	1.04	9.8	0.99			
					GL	4.4	2.23	0.05	1.6	0.04			
000-000	848	131.3	0.56	72.0	0.63	GL	67.6	51.51	1.00	37.1	1.72		
					RD	46.9	35.70	3.39	25.7	0.17			
					GL	16.0	12.21	0.63	8.8	0.98			
					GL	0.8	0.58	0.01	0.4	0.81			
000-CCC	509	5.5	0.02	2.8	0.02	RD	5.5	100.00	0.21	2.8	0.29		
000-JJJ	260	17.1	0.06	4.4	0.04	RD	17.1	100.00	0.67	4.4	0.46		
111-AAA	369	98.9	0.37	36.5	0.32	GR	98.9	100.00	1.45	36.5	1.07		
111-000	244	181.9	0.69	44.4	0.39	GR	186.7	58.67	1.56	28.9	0.76		
					GL	75.2	41.33	1.11	19.3	0.85			
111-CCC	184	93.8	0.25	17.2	0.15	GR	82.8	88.45	1.21	15.2	0.44		
					GL	18.8	11.95	0.16	2.6	0.69			
111-000	235	186.6	0.40	25.1	0.22	GR	42.8	48.12	0.82	10.1	0.29		
					GL	34.9	32.72	0.52	8.2	0.38			
					WT	29.6	27.16	2.09	6.8	1.64			
111-EEE	256	77.5	0.29	19.8	0.17	WT	77.5	100.00	5.60	19.8	4.77		
111-JJJ	430	13.8	0.05	5.9	0.05	GL	13.8	100.00	0.20	5.9	0.27		
444-AAA	959	181.9	0.28	57.0	0.50	RD	53.7	52.87	2.18	28.9	2.80		
					GL	40.7	39.82	0.48	22.7	0.51			

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WITPA CASS		INITIAL STATE		T R A F F I C D A T A									
MARKET	DIST.	PAX/DAY	STOT KPM/DAY	STOT	IO	PAX/DAY	STOT	SCAR KPM/DAY	SCAR	PAX/DAY	STOT	SCAR KPM/DAY	SCAR
AAA-BBB	233	175.4	0.00	40.8	0.36 : GL	140.3	79.99	2.08	32.7	1.51	0.11	4.2	0.20
AAA-BBB	233	175.4	0.00	40.8	0.36 : RD	35.1	20.01	1.37	8.2	0.04			
AAA-CCC	306	182.0	0.61	62.5	0.55 : GL	90.8	56.05	1.34	35.0	1.62			
AAA-CCC	306	182.0	0.61	62.5	0.55 : RD	71.2	43.95	2.78	27.5	2.83			
AAA-DDD	505	45.7	0.17	26.7	0.23 : GL	31.6	69.11	0.47	18.5	0.86			
AAA-DDD	505	45.7	0.17	26.7	0.23 : RD	14.1	30.89	0.55	8.3	0.05			
AAA-EEE	508	15.2	0.00	8.5	0.07 : BL	15.2	100.00	0.17	8.5	0.19			
AAA-FFF	529	11.7	0.04	6.2	0.05 : BL	6.9	58.53	0.08	3.6	0.08			
AAA-FFF	529	11.7	0.04	6.2	0.05 : GL	4.9	41.47	0.07	2.6	0.12			
AAA-GGG	261	22.3	0.00	5.6	0.05 : RD	22.3	100.00	0.07	5.6	0.58			
AAA-HHH	260	12.7	0.05	3.3	0.03 : RD	12.7	100.00	0.50	3.3	0.34			
AAA-III	420	5.0	0.02	2.1	0.02 : GL	5.0	100.00	0.07	2.1	0.10			
AAA-JJJ	401	12.2	0.05	5.6	0.05 : GL	12.2	100.00	0.18	5.6	0.26			
AAA-KKK	422	78.2	0.29	33.0	0.29 : GL	78.2	100.00	1.16	33.0	1.53			
AAA-LLL	303	214.2	0.81	64.9	0.57 : GL	214.2	100.00	3.17	64.9	3.00			
AAA-MMM	179	195.6	0.74	35.0	0.31 : GL	145.9	74.59	2.16	26.1	1.21			
AAA-MMM	179	195.6	0.74	35.0	0.31 : WT	49.7	25.41	3.59	8.9	2.14			
AAA-NNN	330	49.7	0.19	18.4	0.14 : GR	49.7	100.00	0.73	18.4	0.48			
AAA-OOO	187	97.9	0.37	18.3	0.16 : GR	97.9	100.00	1.43	18.3	0.53			
AAA-PPP	230	76.7	0.29	18.1	0.16 : GR	76.7	100.00	1.12	18.1	0.53			
AAA-QQQ	370	30.9	0.12	11.4	0.10 : GR	16.7	54.07	0.24	6.2	0.18			
AAA-QQQ	370	30.9	0.12	11.4	0.10 : WT	14.2	45.93	1.03	5.3	1.26			
AAA-AAA	140	112.5	0.42	16.8	0.15 : BL	112.5	100.00	1.25	16.8	0.37			
AAA-BBB	520	47.7	0.19	25.3	0.22 : BL	47.7	100.00	0.53	25.3	0.56			
AAA-CCC	900	90.6	0.19	25.7	0.22 : BL	33.7	66.57	0.38	17.1	0.38			
AAA-CCC	900	90.6	0.19	25.7	0.22 : GL	16.9	33.43	0.25	8.6	0.40			
AAA-DDD	904	21.0	0.08	10.6	0.09 : BL	21.0	100.00	0.23	10.6	0.24			
AAA-AAA	178	147.3	0.56	26.4	0.23 : BL	112.8	76.60	1.26	20.2	0.45			
AAA-AAA	178	147.3	0.56	26.4	0.23 : GL	34.5	23.40	0.51	6.2	0.29			
AAA-BBB	805	66.2	0.26	47.4	0.41 : GL	53.5	78.47	0.78	37.2	1.72			
AAA-BBB	805	66.2	0.26	47.4	0.41 : BL	14.7	21.53	0.16	10.2	0.23			
AAA-CCC	704	45.2	0.17	31.8	0.28 : BL	45.2	100.00	0.56	31.8	0.71			

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DATA CLASS	INITIAL STATE	T R A P I C D A T A							
MARKET DIST.	PAX/DAY	STOT KPM/DAY	STOT	ID	PAX/DAY	STOT	SCAR KPM/DAY	SCAR	
MMN-000 722	13.1	0.05	9.4	0.08	BL	13.1	100.00	0.15	9.4
000-AAA 200	42.7	0.16	12.8	0.11	BL	42.7	100.00	0.48	12.8
000-000 436	23.4	0.09	10.2	0.09	BL	23.4	100.00	0.26	10.2
000-CCC 840	28.4	0.11	15.3	0.13	BL	28.4	100.00	0.32	15.3
PPP-AAA 182	68.1	0.26	12.4	0.11	BL	68.1	100.00	0.78	12.4
PPP-000 337	47.2	0.18	15.9	0.14	BL	47.2	100.00	0.53	15.9
PPP-CCC 380	48.5	0.18	18.4	0.16	BL	48.5	100.00	0.54	18.4
PPP-000 474	8.8	0.03	4.2	0.04	BL	8.8	100.00	0.10	4.2
MMN-AAA 1804	343.2	1.37	811.7	5.34	GR	211.9	58.33	3.09	356.8
					BL	151.4	41.67	1.69	254.9
MMN-000 2078	101.7	0.20	211.3	1.85	BL	101.7	100.00	1.13	211.3

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## T R A F F I C D A T A

INITIAL STATE

MUTTA CASS

ID	PAX/DAY	KPM/DAY
BL	8973.8	4473.7
GL	6750.2	3159.8
CR	6846.2	3423.8
RD	2558.2	972.2
WT	1384.0	416.1
	26512.4	11445.4

## TABLE 4.12 PERIOD 1 SCHEDULES





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## AIDPLAT ACTIVITY PROFILE FOR STATION AAA

## REF-PTL CAS

TIME	O	FLIGHT	EQ	T/F	PAX
20:16	A	MT	131	DC9	888 56.7
20:33	A	BL	206	727	888 46.3
20:33	D	BL	243	727	EEE 81.4
20:36	D	GL	1701	727	FFF 41.7
20:59	A	CA	506	727	000 51.8
21:10	A	BL	743	707	CCC 87.5
21:30	D	BL	743	707	CCC 89.5
22:27	A	MT	220	DC9	XXX 41.2
22:36	A	BL	244	727	EEE 63.2
22:47	D	MT	220	DC9	888 24.4
22:52	A	CA	14	DC9	CCC 56.0
22:54	A	CA	23	DC9	888 43.6
22:56	D	BL	244	727	FFF 46.5

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## AIRPORT ACTIVITY PROFILE FOR STATION BAA

MIT-JPL CASS

## PROFILE SUMMARY

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	TOT
TOTALS:	1	0	0	0	0	0	5	17	24	11	12	14	15	17	13	14	19	15	16	9	12	2	6	0	222
BL	1	0	0	0	0	0	5	14	1	6	0	5	4	6	0	5	7	5	5	2	2	0	0	0	86
GL	0	0	0	0	0	0	1	3	2	4	3	1	5	2	3	3	1	6	0	5	0	0	0	0	42
GR	0	0	0	0	0	0	4	6	6	5	3	2	5	7	4	4	5	3	2	1	0	2	0	0	64
RD	0	0	0	0	0	0	2	0	0	0	1	0	0	1	1	1	2	0	1	0	0	0	0	0	8
WT	0	0	0	0	0	0	1	2	1	0	2	0	4	1	1	2	2	0	1	1	0	2	0	0	26

CARRIER	DEPARTURES	ARRIVALS	EMPLANEMENTS	DEPLANEMENTS	AV ENP/DEP	AV DEP/ARR	AV PAS/OP
BL	44	44	3101.3	3175.1	72.3	72.2	72.2
GL	21	21	1221.1	1217.3	56.1	57.7	57.9
GR	32	32	1704.5	1657.0	55.9	51.4	53.9
RD	4	4	204.8	195.3	51.7	48.8	50.3
WT	10	10	432.9	483.1	43.3	48.3	45.8

## FILES USED:

USER ID NAME	FILE	LAST MODIFIED	LAST USED	UNIVERSE	LAST MODIFIED
1 BL BLUE	BLUE-01	80/02/11 10:02:17.00	80/02/11 23:23:31.00	FAA_0001	80/01/18 14:16:37.00
2 GL GULLO	GULL-01	80/02/11 21:54:28.00	80/02/11 23:23:31.00	FAA_0001	80/01/18 14:16:37.00
3 GR GREEN	GREEN-01	80/02/11 17:04:27.00	80/02/11 23:23:31.00	FAA_0001	80/01/18 14:16:37.00
4 RD RED	RED-01	80/02/11 16:13:31.00	80/02/11 23:23:31.00	FAA_0001	80/01/18 14:16:37.00
5 WT WHITE	WHITE-01	80/02/11 16:16:06.00	80/02/11 23:23:31.00	FAA_0001	80/01/18 14:16:37.00



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## AIRPORT ACTIVITY PROFILE FOR STATION 000

MID-PFL CASS

## PROFILE SUMMARY

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	TOT
TOTALS:	0	1	0	0	0	0	3	11	11	8	12	11	18	10	6	13	10	10	12	16	5	10	3	0	172
BL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
RD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90
WT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10

CARRIER	DEPARTURES	ARRIVALS	EMPLACEMENTS	DEPLACEMENTS	AV EMP/DEP	AV DEP/ARR	AV PAX/DP
BL	22	22	1649.2	1644.4	75.0	74.7	74.9
CL	21	21	1298.6	1321.6	61.8	62.9	62.4
GR	25	25	1074.1	1747.7	67.0	69.9	68.4
RD	9	9	474.7	444.2	52.7	51.4	52.2
WT	9	9	477.2	458.5	53.0	50.9	52.0

## FILES USED:

UNIVERSE ID NAME	FILE	LAST MODIFIED	LAST USED	UNIVERSE	LAST MODIFIED
1 BL BLUE	BLUE-01	00/02/11 16102147.00	00/02/11 23123131.00	FAA_0001	00/01/10 14161037.00
2 CL GOLD	GOLD-01	00/02/11 21154128.00	00/02/11 23123131.00	FAA_0001	00/01/10 14161037.00
3 GR GREEN	GREEN-01	00/02/11 17044227.00	00/02/11 23123131.00	FAA_0001	00/01/10 14161037.00
4 RD RED	RED-01	00/02/11 16113131.00	00/02/11 23123131.00	FAA_0001	00/01/10 14161037.00
5 WT WHITE	WHITE-01	00/02/11 16136100.00	00/02/11 23123131.00	FAA_0001	00/01/10 14161037.00



PAGE 2

## AIRPORT ACTIVITY PROFILE FOR STATION CEC

MIS-OTL CASS

## PROFILE SUMMARY

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	TOT
TOTALS:	0	0	0	0	0	0	2	9	12	13	10	8	14	15	16	4	17	15	9	33	5	4	2	100	
BL	0	0	0	0	0	0	1	2	1	3	4	1	3	4	5	1	4	3	2	2	2	2	1	44	
CL	0	0	0	0	0	0	1	2	1	2	1	1	1	4	3	4	2	4	2	4	2	1	1	48	
GR	0	0	0	0	0	0	0	0	2	1	2	1	3	3	4	2	4	2	3	4	2	1	1	48	
RD	0	0	0	0	0	0	0	0	2	1	1	1	1	1	3	0	0	0	2	0	1	0	0	28	
WT	0	0	0	0	0	0	0	1	4	1	1	1	5	1	1	3	0	0	2	0	1	0	0	28	

CARRIER	DEPARTURES	ARRIVALS	EMPLACEMENTS	DISPLACEMENTS	AV END/DEP	AV DEP/ARR	AV PAS/DP
BL	22	22	1937.6	1909.1	88.1	88.0	81.4
CL	24	26	1645.4	1623.4	89.7	87.6	88.2
GR	24	24	1741.4	1725.4	72.6	72.1	72.5
RD	14	14	825.8	825.8	56.9	56.8	57.0
WT	10	10	491.2	507.9	49.1	50.8	50.8

CARRIER	DEPARTURES	ARRIVALS	EMPLANEENTS	DEPLANEENTS	AV EMP/DEP	AV DEP/ARR	AV PAX/DP
BL	22	22	1937.6	1906.1	86.1	86.8	87.4
CL	24	24	1649.6	1623.4	68.7	67.6	68.2
GR	24	24	1741.4	1729.6	72.6	72.1	72.3
RD	14	14	796.7	825.8	56.9	59.0	57.9
WT	10	10	491.2	507.9	46.1	50.0	50.0

## FILES USED:

USER ID NAME	FILE	LAST MODIFIED	LAST USED	UNIVERSE	LAST MODIFIED
1 BL BLUE	BLUE-01	00/02/11 18:02:17.00	00/02/11 23:23:31.00	FAA_0001	00/01/18 14:16:37.00
2 CL GOLD	GOLD-01	00/02/11 21:54:28.00	00/02/11 23:23:31.00	FAA_0001	00/01/18 14:16:37.00
3 GR GREEN	GREEN-01	00/02/11 17:04:27.00	00/02/11 23:23:31.00	FAA_0001	00/01/18 14:16:37.00
4 RD RED	RED-01	00/02/11 14:13:31.00	00/02/11 23:23:31.00	FAA_0001	00/01/18 14:16:37.00
5 WT WHITE	WHITE-01	00/02/11 14:36:00.00	00/02/11 23:23:31.00	FAA_0001	00/01/18 14:16:37.00









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## TABLE 4.13 PERIOD 2 SCHEDULES





DATE	TIME	FROM	TO	FLIGHT	STATUS	REMARKS
10-27-70	0555	MEMPHIS	MEMPHIS	1	OK	
10-27-70	0600	MEMPHIS	MEMPHIS	2	OK	
10-27-70	0605	MEMPHIS	MEMPHIS	3	OK	
10-27-70	0610	MEMPHIS	MEMPHIS	4	OK	
10-27-70	0615	MEMPHIS	MEMPHIS	5	OK	
10-27-70	0620	MEMPHIS	MEMPHIS	6	OK	
10-27-70	0625	MEMPHIS	MEMPHIS	7	OK	
10-27-70	0630	MEMPHIS	MEMPHIS	8	OK	
10-27-70	0635	MEMPHIS	MEMPHIS	9	OK	
10-27-70	0640	MEMPHIS	MEMPHIS	10	OK	
10-27-70	0645	MEMPHIS	MEMPHIS	11	OK	
10-27-70	0650	MEMPHIS	MEMPHIS	12	OK	
10-27-70	0655	MEMPHIS	MEMPHIS	13	OK	
10-27-70	0700	MEMPHIS	MEMPHIS	14	OK	
10-27-70	0705	MEMPHIS	MEMPHIS	15	OK	
10-27-70	0710	MEMPHIS	MEMPHIS	16	OK	
10-27-70	0715	MEMPHIS	MEMPHIS	17	OK	
10-27-70	0720	MEMPHIS	MEMPHIS	18	OK	
10-27-70	0725	MEMPHIS	MEMPHIS	19	OK	
10-27-70	0730	MEMPHIS	MEMPHIS	20	OK	
10-27-70	0735	MEMPHIS	MEMPHIS	21	OK	
10-27-70	0740	MEMPHIS	MEMPHIS	22	OK	
10-27-70	0745	MEMPHIS	MEMPHIS	23	OK	
10-27-70	0750	MEMPHIS	MEMPHIS	24	OK	
10-27-70	0755	MEMPHIS	MEMPHIS	25	OK	
10-27-70	0800	MEMPHIS	MEMPHIS	26	OK	
10-27-70	0805	MEMPHIS	MEMPHIS	27	OK	
10-27-70	0810	MEMPHIS	MEMPHIS	28	OK	
10-27-70	0815	MEMPHIS	MEMPHIS	29	OK	
10-27-70	0820	MEMPHIS	MEMPHIS	30	OK	
10-27-70	0825	MEMPHIS	MEMPHIS	31	OK	
10-27-70	0830	MEMPHIS	MEMPHIS	32	OK	
10-27-70	0835	MEMPHIS	MEMPHIS	33	OK	
10-27-70	0840	MEMPHIS	MEMPHIS	34	OK	
10-27-70	0845	MEMPHIS	MEMPHIS	35	OK	
10-27-70	0850	MEMPHIS	MEMPHIS	36	OK	
10-27-70	0855	MEMPHIS	MEMPHIS	37	OK	
10-27-70	0900	MEMPHIS	MEMPHIS	38	OK	
10-27-70	0905	MEMPHIS	MEMPHIS	39	OK	
10-27-70	0910	MEMPHIS	MEMPHIS	40	OK	
10-27-70	0915	MEMPHIS	MEMPHIS	41	OK	
10-27-70	0920	MEMPHIS	MEMPHIS	42	OK	
10-27-70	0925	MEMPHIS	MEMPHIS	43	OK	
10-27-70	0930	MEMPHIS	MEMPHIS	44	OK	
10-27-70	0935	MEMPHIS	MEMPHIS	45	OK	
10-27-70	0940	MEMPHIS	MEMPHIS	46	OK	
10-27-70	0945	MEMPHIS	MEMPHIS	47	OK	
10-27-70	0950	MEMPHIS	MEMPHIS	48	OK	
10-27-70	0955	MEMPHIS	MEMPHIS	49	OK	
10-27-70	1000	MEMPHIS	MEMPHIS	50	OK	

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UNIT-FLY CASE	TIME @ FLIGHT	SR	Y/P	PAK	ALMOST FLIGHT	ACTIVITY	PROFLE	END STATION	DEC.	TIME @ FLIGHT	SR	Y/P	PAK	TIME @ FLIGHT	SR	Y/P	PAK		
11804 A FL 312	679	289	44-6		131:28	A	UT 211	679	100X	48-0				141:54	A	R02030	727	500	94-2
4100 D OR 401	727	AAA	101-7		111:48	A	UT 211	727	2889	51-3				171:00	D	UL 403	727	AAA	99-4
4189 D FL 301	727	AAA	101-2		111:53	A	UT 110	679	47-9					171:15	D	R02030	727	500	42-0
7100 D FL 1711	707	AAA	113-4		111:58	A	UT 110	679	44-4					171:40	D	UL 403	727	AAA	99-4
7120 D FL 210	727	AAA	104-2		121:03	D	UL 214	727	288	98-3				171:25	D	UL 214	727	AAA	99-4
7134 A R02030	727	AAA	67-5		121:13	D	UT 110	679	44-5					171:28	A	R02030	727	500	44-3
7144 A OR 31	679	288	66-6		121:17	D	UT 102	727	AAA	101-0				171:41	A	OR 31	679	288	52-3
7146 A UT 400	679	288	66-6		121:18	D	UT 110	679	44-5					171:41	A	UT 400	679	288	52-3
7154 D R02030	727	500	104-8		121:22	A	R02030	727	500	46-7				171:44	A	R02030	727	500	46-7
7159 D FL 301	679	288	79-2		121:48	A	UT 110	679	44-5					171:46	A	UL 1700	727	500	114-3
8104 D UT 200	679	288	83-8		121:59	A	UL 1001	679	500	43-9				181:00	A	UL 1133	679	288	95-1
8106 D UT 200	679	288	73-1		131:05	D	R02030	727	500	31-7				181:01	D	R02030	727	500	90-9
8122 A UT 400	679	288	64-7		131:07	D	UT 403	727	500	100-3				181:01	A	UT 131	679	288	42-4
8124 A UL 1000	679	288	52-7		131:12	A	UL 101	679	44-5					181:01	A	UL 101	679	288	90-9
8125 A UL 101	679	288	52-7		131:12	A	UL 101	679	44-5					181:01	A	UL 101	679	288	90-9
8141 A R02030	727	500	78-0		131:20	D	UL 1103	679	44-4	37-5				181:21	D	UT 131	679	288	40-3
8143 D UL 1000	679	288	42-9		131:20	D	UL 401	727	500	90-2				181:35	A	UL 804	679	288	40-3
8150 D UL 1131	679	288	42-9		131:40	A	UL 1133	679	288	48-3				181:43	A	UL 43	679	288	74-4
8155 D UT 101	679	288	39-8		131:44	A	UL 1103	679	500	43-4				181:51	A	UL 1713	707	AAA	118-3
8159 A UL 1101	679	288	72-1		131:56	A	UT 411	679	44-5	35-1				181:55	D	UL 804	679	288	40-4
9113 A OR 201	727	AAA	102-5		131:59	A	UL 302	727	288	97-7				191:01	A	UL 1103	679	288	50-4
9119 D UL 101	679	288	50-5		141:00	D	UL 1133	679	AAA	49-8				191:03	D	OR 43	679	288	47-4
9124 A UL 100	727	AAA	98-9		141:14	A	UT 411	679	288	47-1				191:11	D	UL 1701	727	288	102-7
9127 A UL 100	727	AAA	97-8		141:39	A	UL 1712	707	AAA	116-8				191:21	D	UL 1103	679	288	47-7
9127 A OR 401	727	AAA	103-2		141:39	A	UT 510	679	288	54-4				191:24	A	R02053	679	1944	50-3
9128 A UL 204	727	AAA	107-9		141:42	A	UL 211	727	288	97-9				191:34	A	UL 703	679	288	38-8
9129 D UL 204	727	AAA	100-7		141:42	A	UL 211	727	288	97-9				191:34	A	UL 1714	707	AAA	113-7
9130 D UL 204	727	AAA	100-7		141:42	A	UL 211	727	288	97-9				191:34	A	UL 1714	707	AAA	113-7
9137 D UL 100	727	288	86-6		141:59	D	UT 510	679	288	54-9				191:44	A	R02044	679	288	49-3
9142 A UT 304	727	288	97-4		151:02	D	R02043	679	288	74-1				191:59	A	UL 132	727	500	45-0
9142 A UT 304	679	288	97-4		151:02	D	R02043	679	288	74-1				201:00	A	OR 404	727	500	92-4
10049 A OR 31	679	111	44-8		151:10	A	OR 403	727	288	94-3				201:04	A	UL 213	727	288	100-4
10049 A R02030	727	500	101-9		151:10	A	UT 257	727	288	84-4				201:09	A	UT 420	679	288	44-0
10049 A R02030	727	500	101-9		151:10	A	UT 257	727	288	84-4				201:10	A	UL 132	727	500	44-0
10113 D UT 590	679	288	37-4		151:26	A	UL 205	727	AAA	104-3				201:23	A	R02030	727	500	48-9
10120 D OR 31	679	111	47-4		151:38	A	UL 101	727	288	98-8				201:27	A	UL 102	727	500	92-7
10120 D R02030	727	500	93-3		151:44	A	UL 102	727	AAA	101-8				201:34	D	OR 45	679	288	48-3
10127 A UL 1711	707	AAA	118-4		151:50	D	OR 605	727	500	98-6				201:43	D	R02030	727	500	30-8
10127 A OR 41	679	288	67-9		161:00	D	UL 101	727	288	98-9				201:47	D	UL 102	727	500	94-8
10127 A OR 41	679	288	67-9		161:00	D	UL 101	727	288	98-9				201:50	A	OR 404	727	500	107-0
10151 D UL 210	727	288	44-6		161:20	D	R02051	679	1944	53-4				211:00	D	UL 703	679	288	29-4
10151 D UL 210	727	288	44-6		161:20	D	R02051	679	1944	53-4				211:00	D	R02045	679	288	71-3
10151 D UL 210	727	288	44-6		161:20	D	OR 44	679	288	79-2				211:07	A	OR 504	727	500	91-1
11102 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11112 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	727	500	91-1				211:12	A	OR 104	727	500	99-2
11120 A UT 300	679	288	94-0		161:40	A	UL 462	7											

[illegible]



AIRPORT ACTIVITY PROFILE FOR STATION 180										AIRPORT ACTIVITY PROFILE FOR STATION 180													
TIME	FLIGHT	OR	T/F	PAS	TIME	FLIGHT	OR	T/F	PAS	TIME	FLIGHT	OR	T/F	PAS	TIME	FLIGHT	OR	T/F	PAS				
06:00	A	DL 312	579	AAA	43.9	10:05	B	DL 100	727	000	38.5	18:00	A	DL 121	727	000	70.7	19:00	A	DL 1701	727	000	41.0
11:00	B	DL 312	579	CCC	51.1	10:37	A	DL 1703	727	000	108.0	18:14	A	DL 1703	727	000	70.7	20:00	A	DL 1703	727	000	38.5
11:15	A	WT 220	579	AAA	48.5	10:59	A	DL 1703	727	000	50.9	18:34	A	DL 1703	727	000	70.7	20:10	A	DL 1703	727	000	38.5
21:04	A	DL 1704	707	AAA	23.0	11:02	A	DL 231	727	000	59.5	18:50	A	DL 231	727	000	70.7	20:15	A	DL 1703	727	000	38.5
41:00	B	DL 400	727	000	33.2	11:14	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	20:24	A	DL 224	727	000	38.5
41:30	B	DL 400	727	000	33.2	11:17	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	20:29	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:19	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	20:34	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:20	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	20:39	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:21	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	20:44	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:22	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	20:49	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:23	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	20:54	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:24	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:00	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:25	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:05	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:26	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:10	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:27	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:15	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:28	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:20	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:29	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:25	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:30	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:30	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:31	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:35	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:32	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:40	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:33	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:45	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:34	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:50	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:35	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	21:55	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:36	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:00	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:37	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:05	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:38	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:10	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:39	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:15	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:40	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:20	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:41	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:25	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:42	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:30	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:43	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:35	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:44	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:40	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:45	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:45	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:46	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:50	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:47	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	22:55	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:48	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:00	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:49	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:05	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:50	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:10	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:51	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:15	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:52	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:20	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:53	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:25	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:54	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:30	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:55	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:35	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:56	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:40	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:57	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:45	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:58	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:50	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	11:59	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	23:55	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:00	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:00	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:01	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:05	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:02	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:10	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:03	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:15	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:04	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:20	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:05	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:25	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:06	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:30	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:07	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:35	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:08	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:40	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:09	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:45	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:10	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:50	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:11	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	70.7	24:55	A	DL 224	727	000	38.5
41:50	B	DL 400	727	000	33.2	12:12	B	DL 503	727	000	40.5	19:00	B	DL 121	727	000	7						



## TABLE 4.14 PERIOD 1 TRAFFIC DATA

WTF-TE CRSC		ITERATION 01		T W A F F I C D A T E									
NAME/ST	DIST.	PAR/DAY	STOT	MPH/DAY	STOT	IF	PAR/DAY	STOT	MPH/DAY	STOT	IF	PAR/DAY	STOT
<hr/>													
AAA-BMR	517	1129.5	4.41	584.0	4.48	AL	484.1	47.21	6.64	252.3	6.24		
						GP	317.2	28.04	4.95	164.0	5.56		
						GL	237.3	21.01	3.70	122.7	4.07		
						BT	74.2	4.75	2.78	39.4	3.59		
						BN	10.7	0.95	0.80	5.5	0.57		
<hr/>													
AAA-CCC	519	2184.0	4.55	1179.4	9.78	AL	791.7	34.14	10.78	424.7	10.62		
						GP	770.7	35.22	12.07	415.4	14.10		
						GL	540.5	24.70	8.44	291.3	9.44		
						BT	85.1	1.89	3.11	45.9	4.14		
<hr/>													
AAA-UDD	544	459.5	3.34	505.4	4.19	AL	457.3	53.20	6.23	248.9	6.49		
						GL	203.4	27.71	3.18	119.8	3.97		
						GP	118.0	13.26	1.78	67.0	2.27		
						BT	84.5	9.83	3.08	49.7	4.53		
<hr/>													
AAA-EEE	187	252.2	0.99	37.1	0.11	AL	211.7	43.94	2.84	31.1	0.77		
						BT	40.5	14.06	1.44	6.0	0.54		
<hr/>													
AAA-FFF	141	149.0	0.66	25.5	0.21	AL	95.2	54.35	1.30	14.4	0.36		
						BT	41.4	24.74	1.53	6.3	0.54		
						GL	31.0	14.89	0.50	4.8	0.16		
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AAA-GGG	442	201.1	0.79	96.9	0.40	AL	88.4	44.14	3.31	42.8	4.38		
						GL	41.1	20.42	0.64	19.8	0.66		
						BT	47.4	20.27	0.55	19.4	0.49		
						BT	30.4	15.13	1.11	14.7	1.34		
<hr/>													
AAA-HHH	745	171.4	0.67	129.5	1.07	AL	80.0	46.63	2.94	40.4	6.14		
						GL	50.4	29.51	0.69	34.2	0.95		
						GL	24.3	14.15	0.38	14.3	0.41		
						GP	16.7	9.71	0.26	12.6	0.44		
<hr/>													
AAA-III	349	51.5	0.20	19.0	0.16	GP	39.9	77.49	0.62	14.7	0.50		
						BT	11.4	22.51	0.42	4.3	0.39		
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AAA-JJJ	549	114.3	0.45	65.0	0.54	AL	57.0	49.77	0.79	32.4	0.81		
						GP	57.4	49.67	2.15	32.3	3.30		
						GL	0.7	0.57	0.01	0.4	0.01		
<hr/>													
AAA-KKK	441	15.4	0.04	6.9	0.06	GL	15.7	71.39	0.17	4.9	0.16		
						BT	4.3	28.41	0.16	2.0	0.14		
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AAA-LLL	370	27.3	0.11	9.0	0.07	GP	27.3	100.00	0.43	9.0	0.31		
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AAA-MMM	179	69.4	0.27	12.5	0.10	BT	41.1	41.90	1.57	7.7	0.70		
						GP	28.5	39.10	0.41	4.7	0.14		
<hr/>													
AAA-NNN	144	144.4	1.51	651.4	5.40	GP	152.4	39.45	2.34	247.0	8.72		
						GL	112.0	24.96	1.75	144.7	6.24		
						AL	84.7	22.94	1.21	149.4	3.72		
						BT	31.5	4.65	1.22	54.4	5.14		
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AAA-AAA	517	1044.3	4.24	540.4	4.45	AL	524.4	44.57	7.17	272.5	6.74		
						GP	244.4	22.77	3.45	127.4	4.14		



MVT-FY07BSC		TYPEATION 01		T R A F F I C D A T A								
MONEY	DIST.	DAYS/DAY	STOT KPH/DAY	STIF	IN PAYS/DAY	STOI	SCAR KPH/DAY	SCAR				
LCC-UMI	202	1424.5	5.58	288.1	2.19	GR	559.9	19.25	8.74	113.1	3.88	
	GL						363.1	25.84	5.67	73.3	2.83	
	RD						284.9	19.98	10.61	57.6	5.89	
							WT	120.9	8.47	6.41	24.4	2.23
							BL	97.7	6.85	1.33	19.7	0.99
LCC-TEL	410	143.5	0.44	71.6	0.59	RL	65.2	2.04	1.16	37.3	0.93	
	GL						WT	64.4	19.38	2.35	28.2	2.57
	GL						GL	14.0	8.57	0.22	4.1	0.70
							ML	6.7	10.54	0.09	4.1	0.10
LCC-GBG	572	130.1	0.51	74.4	0.62	RD	62.5	8.05	2.33	35.8	3.46	
	GL						GL	52.2	40.12	0.41	29.9	0.99
	BL						BL	15.4	11.85	0.21	8.8	0.22
LCC-MNH	340	201.2	0.79	72.4	0.60	RD	110.2	48.74	4.10	39.7	4.06	
	GL						GL	48.9	28.33	0.76	17.6	0.58
	WT						WT	42.0	20.90	1.53	15.1	1.38
LCC-JUG	386	143.3	0.56	55.3	0.46	RD	82.0	57.21	3.05	31.6	3.26	
	GL						GL	57.1	39.87	0.89	22.0	0.73
	WT						WT	4.2	2.92	0.15	1.6	0.15
LCC-MNH	303	191.6	0.75	58.1	0.88	GL	116.3	60.69	1.82	35.2	1.17	
	WT						WT	75.3	39.31	2.75	22.8	2.08
	GL						GL	40.2	150.00	0.63	9.5	0.32
LCC-ILL	216	40.2	0.16	9.5	0.58	GR	40.2	150.00	0.63	9.5	0.32	
	GL						GL	25.6	100.00	0.40	13.0	0.43
	GL						GL	16.2	100.00	0.59	11.4	1.04
UUU-AGA	588	793.3	3.10	466.5	3.87	ML	366.3	44.17	4.99	215.4	5.36	
	GL						GL	243.5	30.70	3.80	181.2	4.74
	GR						GR	140.3	17.64	2.19	82.5	2.80
							WT	43.2	5.44	1.58	25.4	2.32
UUU-MNR	353	771.8	3.02	272.5	2.26	GR	434.0	54.74	6.84	154.6	5.25	
	RL						RL	253.9	32.90	3.66	84.6	2.23
	GL						GL	65.7	4.51	1.02	23.2	0.77
							WT	14.3	1.85	0.52	5.0	0.46
UUU-LCC	202	1437.3	5.57	290.3	2.81	GR	466.9	32.45	7.28	94.2	3.70	
	GL						GL	414.3	24.83	6.47	85.7	2.77
	RD						RD	239.8	16.04	8.93	4.94	0.93
							RL	187.2	12.54	2.45	34.4	0.91
							WT	136.4	9.51	4.98	27.6	2.52
UUU-ECC	443	42.5	0.17	19.3	0.16	LT	23.1	48.37	0.88	16.5	0.86	
	ML						ML	19.8	45.63	0.26	4.8	0.22



TYPING UNIT											
WATER CLASS		T H A F F T C H A T T A									
MARINE	DIST.	PAK/DAY	STOT	KPH/DAY	STOT	IN	PAK/DAY	STOT	SCAR	KPH/DAY	SCAR
FFF-NUD	200	45.8	0.18	32.0	0.27	GL	24.3	53.00	0.38	16.9	0.56
FFF-EFE	200	20.1	0.08	5.8	0.05	AL	20.1	100.00	0.27	5.8	0.16
FFF-MMM	700	6.7	0.03	5.1	0.04	GL	6.7	100.00	0.10	5.1	0.17
666-AAA	402	190.1	0.74	91.7	0.76	RD	83.4	43.95	3.11	40.3	4.12
						AL	44.8	23.43	0.61	21.5	0.53
						WT	13.5	7.08	0.49	6.5	0.59
666-BMM	400	188.9	0.74	82.0	0.68	AL	69.2	34.63	0.94	30.0	0.75
						RD	55.8	29.54	2.08	24.2	2.48
						GL	43.8	22.97	0.68	19.8	0.62
						WT	20.5	10.86	0.75	8.9	0.81
666-CCC	572	137.4	0.58	78.7	0.65	RD	71.7	52.10	2.67	41.0	4.20
						GL	65.9	47.90	1.03	37.7	1.25
666-DDD	707	68.6	0.27	51.2	0.42	RD	42.7	62.24	1.59	31.9	3.26
						GL	25.9	37.72	0.40	19.3	0.68
666-EFF	508	18.9	0.07	10.4	0.09	WT	14.8	76.07	0.58	8.1	0.78
						AL	8.2	21.93	0.06	7.3	0.06
666-MMM	509	9.8	0.04	5.0	0.04	RD	9.8	100.00	0.37	5.0	0.51
666-JJJ	251	33.8	0.13	8.5	0.07	RD	25.8	76.47	0.96	8.5	0.66
						AL	8.0	23.53	0.29	2.0	0.18
MMM-AAA	755	173.5	0.67	129.5	1.07	RD	82.8	48.24	3.08	42.5	6.39
						AL	43.7	25.48	0.59	39.0	0.82
						GL	27.0	15.72	0.82	20.8	0.48
						GR	10.9	6.36	0.17	8.2	0.28
						BT	7.1	4.16	0.26	5.4	0.49
MMM-BMM	259	241.7	0.94	62.6	0.52	RD	162.0	67.08	6.03	42.0	4.29
						AL	41.6	17.21	1.52	10.8	0.98
						GL	37.3	15.41	0.58	9.7	0.32
						GR	0.7	0.29	0.01	0.2	0.01
MMM-CCC	350	203.7	0.79	72.6	0.60	RD	133.2	66.05	6.96	48.0	4.90
						AL	36.5	18.12	0.57	13.2	0.88
						BT	31.9	15.81	1.16	11.5	1.05
MMM-DDD	508	114.0	0.45	63.6	0.53	GL	84.0	72.41	1.31	46.0	1.53
						GR	32.0	27.59	0.50	17.5	0.60
MMM-EFE	711	17.1	0.07	12.1	0.10	WT	17.1	100.00	0.62	12.1	1.11
MMM-FFF	700	8.0	0.03	5.1	0.04	AL	6.8	100.00	0.11	5.1	0.17
MMM-GGG	509	9.0	0.04	5.0	0.04	RD	7.0	80.37	0.30	8.0	0.41
						GL	1.9	18.61	0.03	1.0	0.03
MMM-IJJ	240	25.4	0.10	6.6	0.05	RD	19.8	76.31	0.72	5.0	0.82



[illegible]

MARKET DATA									
MARKET	DISC.	PAID/DAY	STOT	PER/DAY	STOT	PER/DAY	STOT	PER/DAY	STOT
MARK-AAA	500	22.5	0.00	11.4	0.09	61	22.5	100.00	0.35
MARK-CCC	179	51.9	0.20	9.7	0.08	61	51.9	100.00	1.89
MARK-AAA	695	67.1	0.26	46.7	0.10	68	47.8	71.35	0.75
MARK-AAA	704	25.4	0.10	18.0	0.15	68	17.0	50.72	0.20
MARK-AAA	732	17.1	0.05	8.7	0.07	68	12.4	49.28	0.44
MARK-AAA	1044	413.2	1.62	695.9	5.77	68	141.6	34.26	2.21
MARK-AAA	2078	350.4	1.37	728.2	4.04	68	131.7	31.88	2.04
MARK-AAA						68	107.1	25.91	1.46
MARK-AAA						68	32.4	7.95	1.20
MARK-AAA						68	205.0	54.51	2.79
MARK-AAA						68	61.4	18.08	0.99
MARK-AAA						68	61.7	17.62	0.96
MARK-AAA						68	20.1	5.80	0.74
MARK-AAA						68	47.2	47.2	3.85

MISCELLANEOUS INFORMATION OF		Y N A F F I C I O U S	
		TD	PAY/DAY KPM/DAY
AL	7345.4	4017.4	
GL	6407.2	3016.1	
GR	6404.7	2944.9	
RO	2665.3	977.7	
LT	2782.2	1096.9	
		-----	
		25584.8	12055.5

TABLE 4.15 PERIOD 2 TRAFFIC DATA



UNIT-TEST CROSS		TIME-TEST W 02		T A F T C U S Y A							
NAME	UNIT	PER/DAY	STOT	WPD/DAY	ST.1	1D	PER/DAY	WPD	RCAR	KPM/DAY	RCAR
BMB-288	517	1077.3	0.31	357.6	0.56	ML	335.3	40.69	7.84	276.8	7.14
						GP	240.4	22.34	3.81	124.4	3.87
						GL	170.1	15.79	2.61	84.0	2.90
						WT	119.3	11.04	4.28	61.7	5.56
						PD	31.9	1.10	0.45	4.1	0.61
BMB-CCC	153	1721.3	0.57	263.4	2.16	GP	521.4	30.30	7.39	79.8	2.49
						ML	405.4	21.54	5.64	62.0	1.61
						GL	401.3	23.31	6.15	61.4	2.02
						RD	214.4	12.42	6.12	32.6	3.24
						BT	174.4	10.38	6.41	27.3	2.44
BMB-QUU	353	794.4	3.04	281.1	2.10	GP	413.7	51.82	5.85	144.7	4.44
						GL	194.0	24.61	3.00	69.2	2.28
						ML	181.8	22.83	2.53	64.2	1.67
						WT	5.9	0.74	0.21	2.1	0.19
BMB-ELL	455	233.7	0.49	106.4	0.47	ML	154.7	47.91	2.21	72.2	1.27
						WT	44.2	14.65	1.54	20.1	1.81
						GL	30.9	11.20	0.47	14.0	0.46
BMB-FFI	553	87.4	0.33	46.3	0.40	GL	57.4	46.11	0.49	31.9	1.04
						ML	29.4	31.89	0.41	14.4	0.42
BMB-666	414	172.1	0.46	74.7	0.61	RD	90.1	52.33	3.41	39.1	3.89
						ML	52.2	10.33	0.71	22.7	0.59
						GL	29.8	17.34	0.44	13.0	0.43
BMB-MNH	259	220.0	0.84	57.0	0.47	RD	173.4	74.92	6.58	45.0	4.47
						GL	41.1	12.64	0.63	10.6	0.35
						GP	5.3	2.40	0.07	1.4	0.04
BMB-III	244	83.9	0.32	20.5	0.17	GP	83.9	10.00	1.19	20.5	0.64
BMB-JIJ	233	168.4	0.44	34.2	0.24	GL	115.4	44.55	1.77	24.9	0.89
						BT	53.0	31.45	1.90	12.3	1.11
BMB-BHK	422	54.4	0.21	23.1	0.14	GL	42.4	74.11	0.64	14.1	0.60
						BT	12.0	21.49	0.43	5.1	0.44
BMB-ILL	147	43.2	0.14	4.1	0.07	GP	43.2	10.00	0.61	4.1	0.24
BMB-BMH	510	41.9	0.31	43.4	0.36	GP	35.0	47.64	0.51	14.0	0.59
						GL	31.2	14.12	0.44	14.5	0.44
						WT	14.7	14.00	0.53	7.8	0.70
BMB-MNH	495	40.1	0.31	57.7	0.46	GP	44.4	47.64	0.92	44.9	1.40
						WT	15.5	14.34	0.54	10.4	0.97
BMB-XKX	2074	325.0	1.24	672.1	0.53	AL	171.7	52.43	2.39	144.7	9.26
						GP	74.4	21.63	1.09	14.6	4.97
						GL	54.9	14.14	0.93	122.5	4.03
						WT	17.4	5.40	0.63	14.5	3.29
CCC-BIA	510	7140.5	0.32	1175.4	0.47	GP	413.7	37.20	11.53	434.2	13.44
						ML	77.4	30.31	10.71	414.2	10.77
						GL	414.4	21.54	7.44	277.2	9.13

UNIT-1		UNIT-2		UNIT-3		UNIT-4		UNIT-5		UNIT-6		UNIT-7		UNIT-8		UNIT-9		UNIT-10		UNIT-11		UNIT-12		UNIT-13		UNIT-14		UNIT-15		UNIT-16		UNIT-17		UNIT-18		UNIT-19		UNIT-20		UNIT-21		UNIT-22		UNIT-23		UNIT-24		UNIT-25		UNIT-26		UNIT-27		UNIT-28		UNIT-29		UNIT-30		UNIT-31		UNIT-32		UNIT-33		UNIT-34		UNIT-35		UNIT-36		UNIT-37		UNIT-38		UNIT-39		UNIT-40		UNIT-41		UNIT-42		UNIT-43		UNIT-44		UNIT-45		UNIT-46		UNIT-47		UNIT-48		UNIT-49		UNIT-50		UNIT-51		UNIT-52		UNIT-53		UNIT-54		UNIT-55		UNIT-56		UNIT-57		UNIT-58		UNIT-59		UNIT-60		UNIT-61		UNIT-62		UNIT-63		UNIT-64		UNIT-65		UNIT-66		UNIT-67		UNIT-68		UNIT-69		UNIT-70		UNIT-71		UNIT-72		UNIT-73		UNIT-74		UNIT-75		UNIT-76		UNIT-77		UNIT-78		UNIT-79		UNIT-80		UNIT-81		UNIT-82		UNIT-83		UNIT-84		UNIT-85		UNIT-86		UNIT-87		UNIT-88		UNIT-89		UNIT-90		UNIT-91		UNIT-92		UNIT-93		UNIT-94		UNIT-95		UNIT-96		UNIT-97		UNIT-98		UNIT-99		UNIT-100		UNIT-101		UNIT-102		UNIT-103		UNIT-104		UNIT-105		UNIT-106		UNIT-107		UNIT-108		UNIT-109		UNIT-110		UNIT-111		UNIT-112		UNIT-113		UNIT-114		UNIT-115		UNIT-116		UNIT-117		UNIT-118		UNIT-119		UNIT-120		UNIT-121		UNIT-122		UNIT-123		UNIT-124		UNIT-125		UNIT-126		UNIT-127		UNIT-128		UNIT-129		UNIT-130		UNIT-131		UNIT-132		UNIT-133		UNIT-134		UNIT-135		UNIT-136		UNIT-137		UNIT-138		UNIT-139		UNIT-140		UNIT-141		UNIT-142		UNIT-143		UNIT-144		UNIT-145		UNIT-146		UNIT-147		UNIT-148		UNIT-149		UNIT-150		UNIT-151		UNIT-152		UNIT-153		UNIT-154		UNIT-155		UNIT-156		UNIT-157		UNIT-158		UNIT-159		UNIT-160		UNIT-161		UNIT-162		UNIT-163		UNIT-164		UNIT-165		UNIT-166		UNIT-167		UNIT-168		UNIT-169		UNIT-170		UNIT-171		UNIT-172		UNIT-173		UNIT-174		UNIT-175		UNIT-176		UNIT-177		UNIT-178		UNIT-179		UNIT-180		UNIT-181		UNIT-182		UNIT-183		UNIT-184		UNIT-185		UNIT-186		UNIT-187		UNIT-188		UNIT-189		UNIT-190		UNIT-191		UNIT-192		UNIT-193		UNIT-194		UNIT-195		UNIT-196		UNIT-197		UNIT-198		UNIT-199		UNIT-200		UNIT-201		UNIT-202		UNIT-203		UNIT-204		UNIT-205		UNIT-206		UNIT-207		UNIT-208		UNIT-209		UNIT-210		UNIT-211		UNIT-212		UNIT-213		UNIT-214		UNIT-215		UNIT-216		UNIT-217		UNIT-218		UNIT-219		UNIT-220		UNIT-221		UNIT-222		UNIT-223		UNIT-224		UNIT-225		UNIT-226		UNIT-227		UNIT-228		UNIT-229		UNIT-230		UNIT-231		UNIT-232		UNIT-233		UNIT-234		UNIT-235		UNIT-236		UNIT-237		UNIT-238		UNIT-239		UNIT-240		UNIT-241		UNIT-242		UNIT-243		UNIT-244		UNIT-245		UNIT-246		UNIT-247		UNIT-248		UNIT-249		UNIT-250		UNIT-251		UNIT-252		UNIT-253		UNIT-254		UNIT-255		UNIT-256		UNIT-257		UNIT-258		UNIT-259		UNIT-260		UNIT-261		UNIT-262		UNIT-263		UNIT-264		UNIT-265		UNIT-266		UNIT-267		UNIT-268		UNIT-269		UNIT-270		UNIT-271		UNIT-272		UNIT-273		UNIT-274		UNIT-275		UNIT-276		UNIT-277		UNIT-278		UNIT-279		UNIT-280		UNIT-281		UNIT-282		UNIT-283		UNIT-284		UNIT-285		UNIT-286		UNIT-287		UNIT-288		UNIT-289		UNIT-290		UNIT-291		UNIT-292		UNIT-293		UNIT-294		UNIT-295		UNIT-296		UNIT-297		UNIT-298		UNIT-299		UNIT	
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PLOTTER DATA		PLOTTER DATA									
NAME	PLT. NO.	DATE	TIME	IN	OUT	IN	OUT	IN	OUT	IN	OUT
UUU-CCC	282	1-5-62	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:00
				GL	414.2	28.44	6.35	414.2	28.44	6.35	2.76
				HL	184.3	12.65	2.56	184.3	12.65	2.56	0.97
				PD	154.2	10.61	4.86	154.2	10.61	4.86	3.11
				BT	135.8	9.39	4.86	135.8	9.39	4.86	2.86
UUU-EEF	483	8-11	2:17	2:17	2:17	2:17	2:17	2:17	2:17	2:17	2:17
				GL	27.5	11.40	0.42	27.5	11.40	0.42	0.43
				BT	12.2	21.20	0.44	12.2	21.20	0.44	0.77
				HL	5.1	11.40	0.07	5.1	11.40	0.07	0.09
UUU-600	787	6-17	0:25	0:25	0:25	0:25	0:25	0:25	0:25	0:25	0:25
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
UUU-MMM	586	13-2-9	0:41	0:41	0:41	0:41	0:41	0:41	0:41	0:41	0:41
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
UUU-III	235	8-10	0:18	0:18	0:18	0:18	0:18	0:18	0:18	0:18	0:18
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
UUU-JJJ	595	5-11	0:21	0:21	0:21	0:21	0:21	0:21	0:21	0:21	0:21
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
UUU-NNN	179	17-5-7	0:27	0:27	0:27	0:27	0:27	0:27	0:27	0:27	0:27
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
UUU-PPN	506	17-3	0:27	0:27	0:27	0:27	0:27	0:27	0:27	0:27	0:27
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
UUU-MNN	722	18-3	0:07	0:07	0:07	0:07	0:07	0:07	0:07	0:07	0:07
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
EEE-AAA	187	29-5-2	1:13	1:13	1:13	1:13	1:13	1:13	1:13	1:13	1:13
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
EEE-PPP	455	24-9-3	0:45	0:45	0:45	0:45	0:45	0:45	0:45	0:45	0:45
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
EEE-CCC	488	18-8-6	0:25	0:25	0:25	0:25	0:25	0:25	0:25	0:25	0:25
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
EEE-UUC	453	7-5-8	0:20	0:20	0:20	0:20	0:20	0:20	0:20	0:20	0:20
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
EEE-PPP	200	24-9	0:10	0:10	0:10	0:10	0:10	0:10	0:10	0:10	0:10
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
EEE-PPP	888	15-8	0:21	0:21	0:21	0:21	0:21	0:21	0:21	0:21	0:21
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68
EEE-III	256	5-11	0:21	0:21	0:21	0:21	0:21	0:21	0:21	0:21	0:21
				GL	42.6	32.07	0.65	42.6	32.07	0.65	0.77
				GP	37.2	28.01	0.53	37.2	28.01	0.53	0.68



WINDYTA CRSS		TBAFFIC 037A									
REPORT	DIST.	DATE/DAY	ST 1	IC	MAX/DAY	ST01	SCAR	KPM/DAY	SCAP		
EE-EE	558	9.2	0.04	5.2	0.04	GL	9.2	100.00	0.14	5.2	0.17
EE-AAA	151	171.2	0.45	25.0	0.21	ML	86.3	52.17	1.24	13.5	0.35
						BT	41.4	24.19	1.49	6.3	0.56
						GL	40.5	23.63	0.62	6.1	0.20
EE-EE	553	101.5	0.39	50.1	0.46	GL	80.5	79.34	1.23	44.5	1.47
						ML	21.0	23.66	0.29	11.6	0.30
EE-EE	612	46.7	0.18	28.6	0.23	ML	26.9	57.55	0.37	16.5	0.43
						GL	19.8	42.45	0.50	12.1	0.40
EE-EE	608	45.1	0.17	31.5	0.26	GL	24.3	53.79	0.37	16.9	0.54
						BT	20.9	46.21	0.75	10.6	1.31
EE-EE	200	20.5	0.06	5.9	0.05	ML	20.5	100.00	0.24	5.9	0.15
EE-EE	740	6.7	0.03	5.1	0.04	GL	6.7	100.00	0.10	5.1	0.17
EE-AAA	402	191.1	0.73	42.1	0.75	MD	86.2	45.10	3.27	41.6	4.13
						ML	49.2	25.76	0.68	23.7	0.62
						GL	41.1	21.49	0.63	19.8	0.65
						BT	14.4	7.66	0.52	7.1	0.68
EE-EE	448	184.9	0.72	42.1	0.67	MD	62.9	33.29	2.38	27.3	2.72
						ML	54.9	29.06	0.76	23.8	0.62
						GL	48.9	25.89	0.75	21.2	0.70
						BT	22.2	11.74	0.40	9.6	0.87
EE-EE	572	124.0	0.48	71.5	0.59	GL	80.1	64.04	1.23	45.8	1.51
						MD	40.9	35.92	1.70	24.7	2.56
EE-EE	747	70.4	0.27	54.6	0.43	MD	41.1	58.63	1.56	30.8	3.07
						GL	14.7	26.53	0.29	13.4	0.46
						ML	19.8	14.84	0.15	7.8	0.20
EE-EE	588	18.3	0.07	10.0	0.04	BT	18.3	100.00	0.65	10.0	0.60
EE-EE	509	9.8	0.04	5.0	0.04	MD	9.8	100.00	0.37	5.0	0.50
EE-JJJ	251	33.4	0.13	8.5	0.07	MD	27.4	81.52	1.04	6.9	0.69
						BT	6.2	18.44	0.22	1.6	0.18
EE-AAA	755	162.9	0.62	123.0	1.01	MD	107.8	65.93	4.07	41.1	8.07
						GL	34.9	22.04	0.55	23.1	0.89
						MD	13.2	8.13	0.10	10.0	0.33
						BT	6.1	3.87	0.23	4.8	0.43
EE-EE	289	238.0	0.91	61.4	0.50	MD	150.8	67.15	4.06	41.4	4.12
						GL	41.7	17.09	0.62	10.5	0.36
						BT	36.8	15.45	1.32	9.5	0.46
						MD	0.7	3.30	0.01	0.2	0.01
EE-EE	340	203.7	0.77	72.4	0.54	MD	137.9	68.39	4.24	40.7	4.94
						GL	32.8	16.01	0.49	11.6	0.34
						BT	31.5	15.60	1.13	11.3	1.02

[illegible]



WEEKLY TASS		11/01/71 TO 11/07/71	
TO	PAID/DAY	KPM/DAY	
RL	7193.6	3854.0	
GL	6525.5	3036.3	
GM	7055.1	3711.1	
WD	2639.6	1005.0	
BT	2787.6	1110.3	
		96201.3	12214.7

APPENDIX B  
RESULTS OF DECEMBER 1979 EXERCISE

**B.1 The Experiment at M.I.T./FTL**

The pilot experiment was performed at M.I.T. the week of December 17-21, 1979. The five airline teams were assigned aircraft as follows:

<u>Team</u>	<u>DC-10</u>	<u>707</u>	<u>727</u>	<u>DC-9</u>
Blue	3	5	12	
Gold		5	10	
Green		5	5	
Red		3	5	2
White			4	1

Each team was represented by one or more players from ECON-FTA staff and the FAA. The total air transportation network involved four major hubs, of which three were slotted, four intermediate size airports and five minor airports. There were 60 aircraft in all, allocated among the five airlines as shown above. Each airline was told its route structure and could obtain detailed information on the demand in each market.

The scheduling of flights was undertaken during the set-up phase, prior to the first slot auction on December 18, 1979, without any slot restrictions. This prior effort also served to test various aspects of the scenario and to allow changes to be made in passenger demand, costs and other structural aspects of the airline management game (AMG). Then, using the flight schedule profile (number of flights by hour and airport) artificial hourly quotas were selected for the three major hubs:

<u>Airport</u>	<u>Quota (flights/hour)</u>
A	13
B	12
C	15

These were selected so that excess demand would surely occur at peak hours. For instance, the original schedules had 26 operations in one peak at Airport A.

The major iterations of the slot auction experiment were undertaken. Each iteration was conducted as follows:

Slot Auction	Bidding round 1
Slot Auction	Bidding round 2
Slot Auction	-----
Slot Auction	Bidding round k
Run market aggregation--print equilibrium prices	
Reschedule flights subject to slot allocation	
Trade slots in aftermarket is possible and necessary	
Airlines submit schedules to AMG	
Run AMG simulation	

In the first iteration there were four rounds of bidding, in the second only two. The auction was terminated by a voting procedure: if four out of five teams voted to stop the auction, it was stopped; otherwise another round of bidding was taken. The auctioneer announced that he could terminate the bidding at any round after the first round based on other criteria, such as lack of change in prices and/or allocations, but in practice this was not applied during the pilot experiment.

## B.2 Problems with the Experiment

There was some evidence of dynamic changes in bidding between rounds, probably due to a combination of learning by the players and deliberate bidding strategy, including speculation in slots. One could not say, looking at the results that the market "settled down." Probably many more rounds of bidding were needed for stabilization of the market. Time was not available at FTL for a large number of rounds. Initially, during Iteration 1, Rounds 1-3, the mechanics of processing bids was rather slow. By the time we had achieved efficiency in bid processing there was only one day of the experiment left, and hence the abbreviated auction in Iteration 2.

There were several major problems in the implementation of the experiment, as far as the scenario and groundrules were concerned.

1. Ambiguity about the players' freedom to change route structure
2. An "average" cost function which hurt the small airlines profitability
3. Start-up difficulties in player understanding of the bidding procedure and market mechanism
4. Fares were fixed and players could not change them
5. No cash flow constraints were imposed.

We discuss of these problems in turn.

1. Apparently some players (team Gold in particular) perceived the game as if deregulation were in full force, meaning that the airline could add or drop any routes it wished. Other players accepted their initially given routes as fixed and used only their ability to add or drop flights on those routes to make profits. This difference in groundrules between airlines emerges clearly in comparing the earnings results for teams Green and Gold<sup>\*</sup>; while Gold was able to substantially improve its profitability from Iteration 0 to Iteration 2 by competing vigorously in Green's markets, Green steadily lost ground. In a properly designed experiment, all players should have identical groundrules.

It doesn't matter so much whether the groundrules do or do not reflect deregulation. It is essential that this decision be made by the game administrator and announced unambiguously to all players.

In approaching their scheduling problem for a six-month season, airlines would mostly enter the slot market with their flight cycles already mapped out. Changes as a result of slot allocation in these cycles would tend to be marginal,

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<sup>\*</sup>See Tables 4 and 5.

since an accommodation to slot restrictions can be expected via "sliding." The difference in behavior between airline players invalidates the simulation to this extent.

2. The cost allocation--e.g., the cost per passenger for handling passengers on each flight--was derived from averages for aircraft type, and hence did not allow for the lower overhead of a small airline (White) as compared with a large airline (Blue). This resulted in a situation where White could not possibly be profitable and Blue could hardly fail to make profits. It is impossible to say what effect this had on the players bidding. See problem (5) below for further discussion.

3. The bidding instructions were clear and unambiguous, but fairly complicated. Not enough time was available for players to learn bidding procedures and strategy. Apparently some players were mistakenly under the impression in Round 2 of Iteration 1 that all bids had to be submitted from scratch. This caused some confusion in the bid processing. Many players entered zero bids, which have no effect whatsoever on this type of market. To enable players to register demands for slots at essentially no cost to the airlines, we suggested a minimum bid of one dollar, which then allowed slot allocation to take place at a price of \$1.00 in off peak hours. From Round 3 of Iteration 1 on, the zero bid was taken as a cancellation of bids previously submitted in the same auction.

Players evidently thought they could individually influence the slot market to a greater extent than is the case. There was a considerable amount of strategic posturing in the bidding, which is a natural part of learning how to use the market, but which does not contribute useful information to the experiment.

Slot speculation was another example of unrealistic behavior--it is hard to believe the airlines would buy a great number of slots which they don't plan to use,



particularly if they must forfeit such slots after one month of nonuse. Nevertheless, speculation is a possibility which should be considered, and some thought might be devoted to penalizing more heavily slot holders who don't use their slots.

4. The fixed fares limited the players unnecessarily and do not reflect the competitive reality. This problem was significant because of the unusually high costs experienced by small airlines due to incorrect cost allocation (the "average" overhead problem--see (2)) and also entailed a lack of consideration of the airlines of whether or not to pass along slot costs to passengers.

5. The worst problem was occasioned by the absence of adequate financial constraints. Since money was virtually "free" to the players, their bidding exceeded industry net earnings by \$43,668 per day at one point in the first auction. Subsequent rounds of bidding failed to completely correct this problem. The final round, for instance, shows net industry earnings of \$62,239 per day and slot payments of \$43,840 per day. Since the earnings include operations at non-slotted airports, the operations at slotted airports may still show a loss.

TABLE B.1A SLOT PRICES AT END OF  
ITERATION 1 (DOLLARS  
PER OPERATION)

HOUR \ AIRPORT	A	B	C
0600	0	0	0
0700	151	63	0
0800	713	353	1
0900	2	101	100
1000	1	152	276
1100	1	328	0
1200	1	351	0
1300	100	14	305
1400	1	176	2
1500	126	14	500
1600	179	76	1
1700	301	2	2
1800	2	353	1
1900	1	100	14
2000	1	276	0
2100	0	177	0
2200	0	0	0

TABLE B.1B SLOT PRICES AT END OF  
ITERATION 2 (DOLLARS  
PER OPERATION)

HOUR \ AIRPORT	A	B	C
0600	3	3	0
0700	740	3	2
0800	0	19	3
0900	155	5	103
1000	56	6	4
1100	42	253	3
1200	157	157	6
1300	332	5	3
1400	7	6	6
1500	182	6	58
1600	244	95	3
1700	351	5	3
1800	114	207	13
1900	6	6	3
2000	6	7	0
2100	0	7	0
2200	3	3	0

TABLE B.2 POTENTIAL SLOT REVENUES (MILLIONS OF DOLLARS PER HALF-YEAR SEASON)				
ITERATION AND ROUND \ AIRPORT	A	B	C	ALL
1.1	0.468	0.745	1.080	2.293
1.2	1.640	2.171	1.455	5.266
1.3	2.314	3.484	2.692	8.490
1.4	3.697	5.478	3.245	12.420
2.1	2.972	0.320	0.032	3.324
2.2	5.611	1.713	0.567	7.891

TABLE B.3 NET EARNINGS BEFORE TAXES OR SLOT PAYMENTS (IN MILLIONS OF DOLLARS PER HALF-YEAR SEASON)			
AIRLINE \ ITERATION	0*	1	2
BLUE	4.30	4.17	4.13
GOLD	-4.99	-1.07	1.69
GREEN	6.00	4.98	5.53
RED	0.270	0.067	0.720
WHITE	-1.020	-0.994	-0.867
ALL	4.560	7.153	11.203
*THERE WERE NO SLOT RESTRICTIONS IN THIS INITIAL ITERATION.			

**TABLE B.4 POTENTIAL SLOT PAYMENTS AFTER EACH BIDDING ROUND  
(MILLIONS OF DOLLARS PER HALF-YEAR)**

AIRLINE \ ITERATION AND ROUND	1.1	1.2	1.3	1.4	2.1	2.2
BLUE	0.478	1.548	1.863	4.030	1.881	2.469
GOLD	0.611	1.369	2.394	3.533	0.003	1.254
GREEN	0.603	1.945	1.736	3.001	0.878	2.102
RED	0.094	0.117	0.435	0.578	0.048	0.228
WHITE	0.472	0.541	0.670	0.854	0.075	0.080
ALL	2.258	5.520	7.098	11.996	2.885	6.133

**TABLE B.5 NET EARNINGS AFTER SLOT PAYMENTS, BEFORE TAXES  
(MILLIONS OF DOLLARS PER HALF-YEAR)**

AIRLINE \ ITERATION	0	1	2
BLUE	4.300	0.140	1.661
GOLD	-4.990	-4.603	0.436
GREEN	6.000	1.979	3.428
RED	0.270	-0.511	0.492
WHITE	-1.020	-1.848	-0.947
ALL	4.560	-4.843	5.070

TABLE B.6 SYSTEMWIDE PERFORMANCE OF ALL FIVE AIRLINES

FACTOR \ ITERATION	0	1	2
1. LOAD FACTOR	0.627	0.620	0.650
2. AVERAGE STAGE LENGTH (MILES)	338	357	387
3. AVERAGE TRIP LENGTH "	423	437	456
4. RATION OF (3) to (2)	1.25	1.22	1.18
5. TOTAL FLIGHTS	222	211	187
6. TOTAL RUNWAY OPERATIONS	974	938	830
7. RUNWAY OPERATIONS AT AIRPORTS A, B, C	580	544	488
8. UNUSED SLOTS AT A, B, C	100	136	192

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